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Saturday, July 28, 1849.

Iron Ores and the Iron Manufacture of the United States.

Continued from page 396.

CONNECTICUT.

No less than ten furnaces in Litchfield county have been for the greater part, or entirely supplied with ore from the "*Ore Hill*" *Mine of Salisbury.*—Besides these ten, which are still in operation, others not now in existence, have drawn from the same source, and also one in New York State. This hill is situated about six miles west from the Housatonic railroad, and within a quarter of a mile of the New York State Line;—it covers several acres of ground, and nearly the whole surface of it has been dug over for ore. Mica and talcose slates are seen on the slope bounding the bed on the east, west and north sides. In the last direction the ground rises for a long distance, and in the alternating beds of slates a bed of limestone has been opened at several points along the NW. and SE. direction, whose dip towards the SW. must carry it near the ore bed.

The bed itself is a vast deposit of ochres, clays and hematite. The ore lies in irregular shaped masses in the other materials, tending, however, to the form of strata conformable to the adjacent rocks. The whole hill has been more or less dug over, and where the ore was most abundant and of the best quality, there the most extensive excavations have been made. It is formed of several varieties, much of it of very choice character, admirably adapted for the manufacture of forge pig iron of the best quality. The Salisbury iron has long been famous for its excellent character for forge iron, and even now its reputation for making the most malleable and toughest bar iron has never been surpassed by iron made from any other mines. This is no doubt in part owing to the care with which the ores are selected. The mine is owned by a company of individuals, who sell the ores to the furnaces at a stipulated price, which is the same whatever ore is taken; and as the purchaser selects his own, of course none but the best goes from the mine. This price was originally forty-two cents per ton in the mine; it has gone on increasing, till now the duty is the extraordinary sum of one dollar and twenty-five cents. For this price the purchaser has the choice of the mine, and the consequence is that a great deal of good ore is rejected, and only that taken which is known to be of the very best quality.—The expense of mining is of course greater here than at other mines of similar character in consequence of this system; it is rated at one dollar and three-quarters per ton. For the same reason, too, the mine has been nearly exhausted, at least above convenient drainage, and a long adit of several hundred yards was commenced in 1847 in the meadow to the south, to drain some fifty feet or so lower than the old workings. This will be of no small consequence in diminishing the expenses of mining, being laid out in the most thorough manner; and even when steam engines may hereafter be put on to work the mine still deeper, this adit will always prove a judicious expenditure in diminishing the height of the water. The best of the Salisbury ore is fibrous and massive hematite of a reddish color, frequently a glossy black on the outside, some specimens mamillary and botryoidal, and some with long pendant stalactites of oxide of iron of great lustre and beauty. These forms appear to be due to the action of water percolating through the seams, carrying the oxide of iron in solution from one place and depositing it in another. In the northeastern part of the mine are large heaps of a dark colored ore which seem to be rejected, that much resemble the highly prized carbonate of iron, though of a different color from that found in the Stockbridge bed in Massachusetts. It is very probable much of the ore now neglected at this mine may hereafter be found valuable.

It is estimated that for the last fifty years, from 250,000 to 300,000 tons of ore have been taken from the ore hill—at least 5000 tons per annum, thus affording a revenue at the present duty, from a few acres of ground, of over $6,000. No mine of gold or silver or copper ever wrought in the United States has yielded such a result. The best quality of the Salisbury iron is made with cold blast, and its actual cost delivered on the railroad averages no less than $30 to the ton. The furnaces running with hot blast consume about fifty bushels less to the ton of iron, and make nearly double as much iron in the same time. The cold blast iron is unsurpassed for the manufacture of chain cables, gun barrels, tires for driving wheels, and other articles requiring great strength.

Chatfield's ore bed, a quarter of a mile southeast from the ore hill, seems to be a continuation of the same deposit, being on the line of the strike of the strata, and affording ore of similar character.—The quantity, however, does not appear to be so great, though several thousand tons have been extracted. It occurs in mica slate like the ore hill bed. It is a valuable deposit.

A bed of great promise has lately been opened one mile to the northwest of the Salisbury bed in the town of *Northeast* in Duchess County, N. York. This too may possibly be a continuation of the same deposit—I shall describe it when treating of the furnaces in their range in the State of New York. This too is a bed of great importance.

There are other beds of minor importance in Salisbury, which turn out at times a considerable amount of ore. *Davis' bed* is the only one that will require particular notice. This is two miles and a half to the northeast of the Salisbury bed. The ore is of good quality, but expensive to raise from the low situation of the mine. It is principally "*wash ore*," much mixed with clay.

The ten furnaces that are principally dependent upon the Salisbury ore bed are *four in Salisbury; two in North Canaan; two in South Canaan; and two in Cornwall*, one of the last named, however, having recently passed into the hands of C. C. Alger, Esq., of Stockbridge, is now supplied with ore from the bed belonging to the Stockbridge Iron Co.

I will give a short description of the character of each of these furnaces and their operations. None of these are near the ore bed, but are built where

Cross Section of the Western Slope of the Kent Ore-bed.

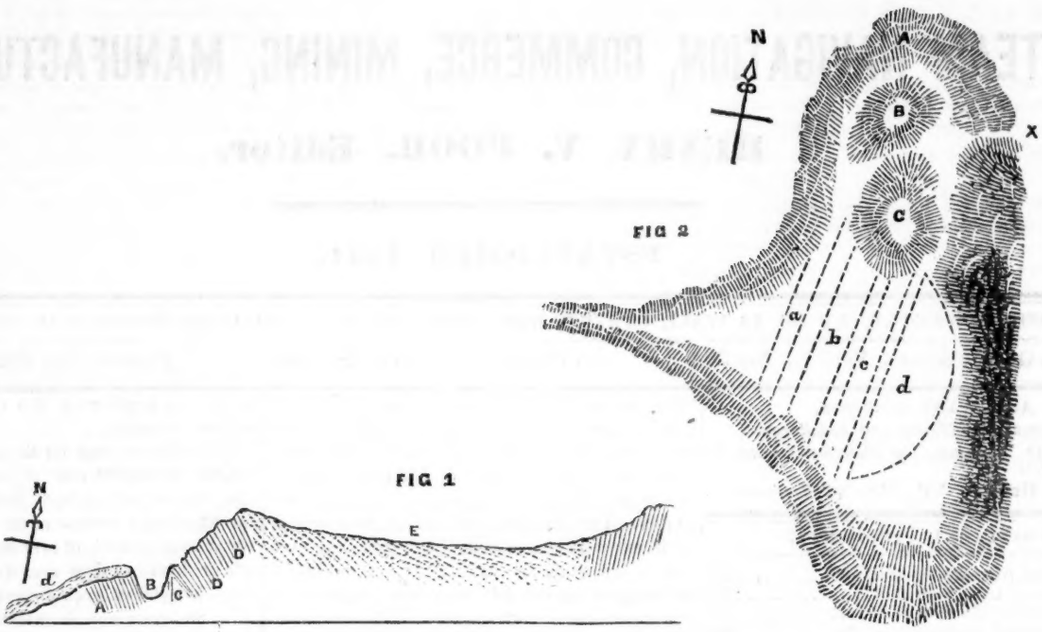

FIG 2

FIG 1

there is convedient water power and the most accessible supplies of fuel. All are along the line of the Housatonic valley within a few miles of the Housatonic railroad.

Chapinville Furnace, situated seven miles to the northeast of the ore bed, was built in 1827, It is 28 feet high and 7 feet across the boshes. Driven by water power. Ore costs—duty, $1 25; mining, $1 75; transportation, $1 – $4 per ton; charcoal $6 50 per 100 bushels. Makes for about eight months in the year three and a quarter tons per day, or 800 tons per annum. Cost of transportation to the railroad is one dollar per ton; three dollars more to New York. Making cold blast iron, the consumption of charcoal is estimated at no less than 200 bushels to the ton.

Joyer's Furnace, is the same distance to the north of the ore bed, was built in 1847, is only 24 feet high, and makes three tons per day. It is cold blast and water power. Cost of materials and transportation hardly varies from that of the Chapinville Furnace.

Mt. Rigu Furnace, four miles north from the ore bed, has been built nearly forty years, is 28 ft high, cold blast and is run by water power. Salisbury ore costs $3 84, charcoal $6; makes 3 tons of iron a day, other expenses like those above. Is in blast only about six months in the year.

Limerock Furnace, five miles from the ore bed, is about 20 years old; cold blast; water power; ore costs $4; charcoal $6 50; yields three tons.

The two furnaces in North Canaan are *Adams' Furnace* and *Beckley's Furnace*. They are eleven miles from the ore bed. The former is about twelve years old, and cold blast; yields 3½ tons per day;—the latter is just built, and with hot air pipes. The cost of the Salisbury ore at these furnaces is $4 75 per ton; charcoal $6; both water power.

The two furnaces in South Canaan are *Church & Scoville's Furnace*, and one belonging to *Hunt, Lyman & Co.* These are about the same distance from the Salisbury ore bed as the North Canaan Furnaces. The expenses of ore and coal are the same. The former furnace is four years old; cold blast; makes 3½ tons, and is three miles from the Canaan Falls railroad depot. The latter was built in 1848, and is five miles from the same depot. It is 32 feet high with hot air pipes.

Cornwall Iron Co. Furnace was built about 14 years since; is only a quarter of a mile from the railroad; it makes about three tons of cold blast iron a day at a cost for material varying little from those above. To both the Cornwall Furnaces charcoal is sometimes offered at 5 instead of $6 the hundred bushels.

Cornwall Bridge Furnace was run until the year 1847 at a similar expense for materials with the the furnace last described. It was then purchased by C. C. Alger, Esq., of Massachusetts, and supplied with ore from the bed in West Stockbridge, a distance of forty miles at a cost of $3 per ton.—The furnace is half a mile from the railroad; makes cold blast iron, and yields 6 tons per day.

In *Sharon*, the next town south of Salisbury, on the west side of Housatonic river, are two furnaces and an ore bed of some importance, called the Indian Pond ore bed. This bed is thus described by Prof. Chas. V. Shepard in his Report on the Geological Survey of Connecticut, 1837.

"The Indian Pond ore bed is situated on the east side of Indian Pond, and directly at the base of a high ridge of mica slate. Its distance from the pond is about sixty rods, and its elevation above it forty or fifty feet. The ore forms a distinctly stratified mass, whose layers correspond in direction and dip to those of the adjoining rock, inclining 45° to the east. A considerable accumulation of diluvium is piled against the bed. The ore is less abundant than at Salisbury. Frequently the strata is too lean to justify explorations, in which case the workmen omit to remove such portions and follow the ore in directions where it is richer. About two thousand tons of ore are annually raised from this deposit at an expense of one dollar and a half per ton. The iron yielded by this ore is less malleable than that of Salisbury, and is principally used for castings." Prof. W. W. Mather states that limestone forms the west and mica slate the east boundary of this bed.

The Sharon Valley Furnace, built some twenty years, is principally supplied from this bed, the furnace company owning the mine. The distance from the mine to the furnace is two miles and a half. The American ore bed in New York State is about ten miles distant, and some ore is hauled from this to mix with the Indian Pond ore. The expense of the ores is estimated at $2 25 per ton at the furnace. Charcoal costs about $7 50 per hundred bushels. This furnace was run with cold blast until about three years since when hot air pipes were put in. It is 35 feet high; water power. Iron made is suitable for castings but not for forge iron.

Weed's Furnace, in Sharon, is a small furnace only about twenty feet high, built in 1845. Its proportions and construction are not good, and it has not been successful. It has been supplied with ore from the Amenia and Northeast ore beds, both over the line in New York. The cost of the ore is estimated at $2 50 per ton; charcoal $7 50.

In the town of *Kent*, on the east side of the Housatonic, are three furnaces and the *Kent ore bed*. This mine is five miles southeast from the village, four miles east from the Housatonic river and two miles from the railroad. Not having visited it myself, I am indebted to Prof. Shepard's Report, already cited, for the following description and plans of the mine:

"It is situated on the western declivity of a low mountain near its base. In length the mountain is about three miles, and in height two hundred feet.

Its length corresponds with the edge of stratification in the vicinity, which do not differ essentially from north by east. Annexed is a cross section of the western slope of the elevation, passing directly across the ore bed.

A. (Fig. 1.) decomposed micaceous gneiss, called by the workmen "grey fuller's earth." Its dip is between 60° and 80° east. It is covered with a thin covering of diluvium. B. Ore bed. This mine is at present (1837) in such an uncleared and neglected condition as completely to conceal the position of the bed. Considerable information, however, was derived from several intelligent miners, who were formerly engaged in its exploration.—From their statements it appears that the ore is situated in a number of nearly parallel veins (beds,) whose direction and dip are nearly coincident with that of the grey fuller's earth, A. Between the beds several feet of grey fuller's earth are interposed.—They state moreover that the fuller's earth, where in contact with the bed of ore, possesses an indurated texture, and has consequently received from them the name of "shell." A ground plat view will render intelligible the direction of these beds, as well as the general figure of the pit, which has been formed in excavating the mine. See fig. 2. A (fig. 2.) Surrounding banks of loose earth, clay and rock. B. and C. Oval elevations or cones of loose earthy materials. D. Bed of stream (generally dry,) over which the water flows that carries out the earth and stone from the bed, and in which the ore is washed. The water employed for this purpose is collected in a depression, E, (fig. 1,) just above the top of the bed, and is let on at X, where a dam and gate are situated. It is only during a short season in the spring and autumn, that they have the command of water adequate to the operation. During a full suply the mine is inundated forty or fifty times in a day. By this means the loose materials, including masses of rock above a foot in diamter are swept through the whole length of the drain for a distance of thirty rods into the low ground.—The height of the inclined plane forming the bed of the stream is about sixty feet. a. Drain vein. b. Chocolate vein. c. Blue Swamp vein. d. Anvil-ledge. The chocolate vein was worked from 70 to 100 feet in length, and about twelve in width. The drain vein had nearly the same width. At present all the beds indicated in the sketch with the exception of the anvil ledge are covered up by the rubbish which has washed down from the banks. Indeed, the working at this place has almost wholly ceased from the depth at which the ore lies, and the danger apprehended from the sliding down of the eastern wall, which overlies the bed in a frightful manner, presenting a nearly vertical front of loose shelly materials, sixty or seventy feet in height. Several slips in this great bank have actually taken place, during which at least a quarter of an acre of rock and earth have been in motion at once, and have given rise to large sinks and chasms on the surface. But one hundred and fifty tons of ore were raised at this place last year; and this was obtained by picking up pieces that had washed out of the banks, and by partial adits, called "burrows" by the workmen, carried horizontally into the banks of grey fuller's earth in the direction of the beds. In farther explanation of the bed, the following references to fig. 1 are added:

C. Decomposing, quartzy mica slate. It dips 80° west, and forms part of the eastern wall to the excavation. D. An alternation of quartz rock, decomposing, micaceous gneiss and quartzy mica slate. They rest their basseting edges on C, and dip 20° east. E. Wet alluvium; during part of the year a shallow pond. It extends back forty rods to the ledge F. F. Gneiss, thick granitic, and occasionally hornblandic. It is nearly vertical, 80° to 85° west.

At present the workmen are directing their attention to a more recent opening, situated 70 or 80 rods north of the old mine, on the same slope and at the same elevation above the valley. It has been worked more or less for a period of thirty years. Until lately the ore was obtained exclusively by burrows; but they have now formed a deep drain, open to the air as at the old bed. From the sides of this drain they carry in burrows, where the workmen operate to advantage during the winter. In this way 150 tons were obtained during the last year by two hands. The ore sells for $3 25 per ton at the mine; one third of which sum is allowed the workmen, together with some privileges connnected with the farm on which the mine is situated.

The Kent ore bed cannot with any degree of propriety be considered as exhausted. The whole distance between the north excavation and the old bed is probably occupied by ore, while the beds in no instance have as yet been dug out in the direction of their stratification. From their relation to the including strata, A. and C., (fig 1,) it would appear indeed that at a depth they must grow very thin, and finally perhaps wedge out altogether. But from the distance of A. and C., it is obvious that this cannot occur short of a very great depth.*

Much of the ore afforded by the anvil ledge, much of which is still accessible, is the variety called by the furnace men "*frost ore.*" It is an iron breccid, consisting of fragments of quartz and ferriginous jasper, cemented together by limonite," (hydrate of iron or hematite) "the aggregate being filled with cavities lined more or less with minute crystals of transparent quartz. Several unsuccessful attempts have been made to reduce it in furnaces, but it has only yielded an inferior kind of cast iron. A different mode of treatment in respect to the kind and quantity of flux might be attended with beiter results. The subject justly merits attention, as thousands of tons of this variety might be raised at a trifling expense. This last described can only be wrought by mixing in small proportion with the least siliceous hematites, and the flux of these must contain but little silex. These highly siliceous mixtures can seldom be managed without great trouble in the blast furnace, and when other ores can be obtained, it is always best to reject them.—Since the above extract was published the Kent ore bed has turned out again large supplies of good hematite, which is used by two of the Kent furnaces and by the Washington Furnace in New Milford. The duty charged is half a dollar per ton.

The Kent ore bed appears to have been worked at quite a remote period. The ore was formerly packed by Indians on their backs from the mine to the various forges in leathern bags. About twenty years since there were sixteen forges in Kent, and the neighboring towns, which worked this ore; at present there are only two, the process of smelting in blast furnaces being found so much more economical than the conversion on the small scale of the ore to malleable iron in the forge fire. Magnetic iron ore from a vein in the town of Southeast, Putnam County, New York, was formerly brought a distance of twenty or thirty miles to mix with the Kent ore. H.

* Is it not more likely that C. is only a portion of a stratum of D. fallen out of place than a regular bed in so unusual position? J. T. H.

Copper Ores of Lake Superior.

Continued from page 434.

NORTH AMERICAN MINE.

The range of trap-rock, in which lies the Cliff mine, described in the last number of the Journal, continues with great regularity its course towards the southwest, only interrupted here and there by a few transverse breaks and depressions in which are generally found veins containing copper. But being exposed in the greenstone trap only, their value in the amygdaloid beneath, where alone they will contain workable quantities of metal, remains in most instances undetermined. The North American mining tract is along a portion of this ridge, half a mile southwest from the Cliff mine, and by the road three and a half miles from the lake. A remarkable break here traverses the ridge, and a number of laumonite and quartz veins were discovered in the southeast face of the cliff several rods north east of it. These veins were never very promising, as to size and regularity, and would hardly have warranted exploration except for their proximity to the Cliff mine, and the general resemblance in position and composition to the vein as originally found there, which subsequently proved so productive. For two years from the 11th December, 1845, mining operations were prosecuted on them with little success; and the probability is the location would have been abandoned, but for the determined resolution and perseverance of the agent of the company, John Bacon, Esq. In the summer of 1847 some bowlders of copper, found in the large gap, called attention to this point; and explorations were here commenced in search of the vein. In the centre of the break shafts and underground levels failed to strike it: but it was finally found clinging to the amygdaloid high up in the eastern wall of the break. Here, near the surface, is proved to be so rich in copper, that the company were greatly encouraged to prosecute the work; but a shaft carried down in the vein passed almost directly into a barren portion of it; and then leaving the vein nothing more was known of it, until a cross cut at the depth of 95 feet, opened it again in December, 1847, where it was rich in stamp-work. From that time operations have been directed to proving the vein in depth and length, and opening it so that a large force can be put to work stoping and removing ore from many points. Two shafts have been sunk—one 215 feet deep, and the other 155 feet, and levels have been extended at the depths of 95 feet, and 215 feet—the upper two 225 feet in length on the lode. The bottom level at present is over 70 feet long, and two parties of miners are driving it north and south. An adit level carries off the water 35 feet below the surface. The quantity of this is not great, except near the surface. One horse-whim, working two hours in the twenty-four, raises it all to the level.

The lode consists of the minerals, quartz, laumonite, chlorite, calc spar and prehnite with copper in course grains, strings and lumps intermixed, forming in many places a rich stamp work; in others the gangue is barren of copper and the vein may be worked many yards without producing anything of value. The rich spots and the barren spots seem to alternate in a stratiform arrangement, their underlay or dip being the same as that of the amygdaloid, which the vein traverses. The same peculiarity was observed at the Cliff mine. Understanding this, the barren portions, when proved by working aronnd them, need never be stoped out. Masses of pure copper are found standing edgewise in the vein; their greatest weight does not exceed two or three tons. About 15 tons in all of these masses have

been extracted. The average thickness of this lode is not more than one foot, and though sometimes thinning out to less than half this width, it is never found, I believe, of more than two feet thickness.—It has furnished of stamp work about 700 tons, of quality not inferior to the stamp work of the Cliff mine, and the supply is now rapidly increasing—there being 24 miners below engaged in "stoping backs," including those driving the bottom levels.

A steam engine has been put up this summer to drive the stamps. There are eight of these, each weighing—the heads 350 lbs., the shafts and iron work about 150 lbs.; their lift 12 inches. It is estimated they will stamp about ten tons of stone a day. The machinery is of the most efficient character and well arranged.

The expenditures up to the present time have been about $45,000; of which about $10,000 were for exploring at various points before striking the main lode. The remainder has been for surface work, as building houses and roads, and clearing land, for mining, and for the purchase of the engine and 800 acres of land.

The mine is properly regarded now as having assumed a decided character, and must well reward the outlay made upon it. Its success, for which the whole credit is due to the perseverance of Mr. Bacon, is of no small consequenee to the whole region—for with the most insignificant show originally to encourage mining operations, the veins of quartz, laumonite, and chlorite in the greenstone being proved to lead to rich veins in the amygdaloid, precisely as at the Cliff mine, a character is given to a multitude of other points presenting similar features scattered throughout the country, which others will hereafter take up and prosecute with confidence and success.

ALBION AND MEDORA.

Next to the North American Mine, a mile further on, on the same ridge, are the veins of the Albion and Medora companies. These companies have now been consolidated into one. Operations were commenced at this tract about the same time as on the North American; and during the summer of 1846 I had an opportunity of witnessing their progress for some time. The outward show of their veins was similar to that of the Cliff and N. A. mines, and was generally regarded much more promising than that of the latter. In position on the ridge, and in mineral composition there was no essential difference in the veins of all these mines as seen in the greenstone trap; excepting only on the top of the ridge, the vein called the Medora afforded solid sheets of a metallic substance, which I found to be composed of copper and arsenic, associated with a small portion of sulphur; perhaps what is described under the name of "white copper."—It is the only substance of the kind I have seen in the country. At the base of the cliff the feeders, struck in search of the vein, contain copper but none of this compound. The amygdaloid here lies much deeper than on the exterior of the ridge eastward. The veins have never yet been proved in this rock, To do this the Albion vein requires an expenditure of from 1,000 to $2,000 in running up an adit from the swamp to the rock—a distance of 480 feet; from the east of which, 72 feet below the surface, as proved by some experimental workings, a shaft may be be carried down on the vein in the amygdaloid. The promise of the vein richly warrents this expenditure. So of the Medora, which may be proved with considerably less expense; the adit being already completed. At present nothing is doing at these mines. A quarter section of land (160 acres) is secured by purchase of the government at the maximum price of $5 per acre—this tract covers all the veins.

On the exterior of this range of trap to the east of the Cliff mine are found the mines of the late *Lake Superior Company* of Boston, now the *Phœnix Company*, on Eagle river, *the Copper Falls Company*, the *North Western Company*, and the *North West* Mining Company—a description of which will be given in the order in which they are named. H.

Crevasses.

The occurrence of a new crevass at Point Coupee on the Mississippi, leads us to offer some remarks on the subject of crevasses generally. The volume of the Missisippi is so immense that people are apt to look on the task of filling up breaches in its embankments as almost hopeless: we may therefore give more correct views on the subject by showing the actual amount of force to be overcome in the case.

The depth of the Mississippi has nothing to do with the amount of rush through a crevasse in its levee: neither indeed has the width of that river.—The velocity of the water passing through the breach is also calculated to give an erroneous idea of the power exerted. The impact of the stream on any surface that may be opposed to it directly, is simply the weight of a column of water having that surface for its base and the mean height of the head corresponding to the velocity for its altitude.—The proof of this is clear enough: the *pressure* of that altitude had met from the levee previous to the breach an *equivalent of resistence*; and this *resistence* being simply that necessary to hold in *equalibrio* a certain *tendency to motion*, the motion resulting from the withdrawal of the resistence is therefore neither more or less than this pressure. Now as water presses equally in every direction, one foot exerting laterally a force equal to a column six inches high-two feet a force equal to a column twelve inches high, and so on in arithmetical progression, the total impact on a dam resisting the stream through a crevass is equal to the weight of a column of water having that dam for its base and half the depth of the water at the face of the dam for its altitude.

The following will, we should think, be found an effective means of stopping crevasses:—First where the depth as in the existing crevass at Point Coupee is not greater than five feet, let two ringbolts of best wrought iron be secured by a nut and washer to the face of a pile planed and straightened on one of its sides; these ringbolts to be so placed that when the pile shall have been driven to the depth required, the lower bolt will have reached the bottom of the channel while the upper shall remain some twelve inches above the water. Forge a collar and screw-thread on one end of a wrought iron jagged bar of such a length that when the collar is screwed home to the under side of the upper ringbolt, the other end of the bar shall be a few inches below the lower ringbolt. One bar of this description is to be bound on firmly to each side of a sheet of strong canvass so that the top of the canvass fits up to the collar; and, being bound along the bar to within a few inches of the point, the tail of the canvass, extending for five or six feet beyond this, is to be loaded with narrow strips of lead sewn on to the canvass vertically. This tail will lie closely to the indentations of the bottom. A pile driver may then be brought along side; and (the bars of the sheeting being fastened into the ringbolts by the collar and screw-nut,) the piles may be driven into position.—Another sheet may then be sunk on another pair of piles, the inside pile of the last sheet making a close joint with the outside pile of the first; and so on pair after pair until the chasm be closed up. In order to save the sides of the crevass, it would be well to commence the operation by spreading canvass or a few sheet piles around them: the canvass of the dam should always be sunk width for width at each side, so that the closing width shall be in the middle.

Secondly, Where the depth is more than five feet we would suggest the following: Take two piles, (straightened as in the above case, or if necessary ploughed and tongued on the edges,) and mount on each an iron bar with ringbolts, as before described, except that in this case the necks of the ringbolts must project from the pile a sufficient length to leave a clear space between the pile and the bar of from three to six or eight inches, as may be required.—In this space fit over two piles a timber sheeting of the necessary scantling, leaving it room vertically to play without straining with any inequality in the driving of the piles. When the piles have been driven into position, close up the joints of the sheeting by driving wedges between the ringbolts and the upper batten of the sheeting. It would be well to attach to the lower timber of the sheeting a tail of canvass loaded as in the former instance, and if found practicable light sheeting piles of some three feet long. In this last case the lower timber must be secured to the piles in a manner to resist upward pressure. If there should be any tendency in the sheeting to slip endwise out of its place, it had better be held by wooden keys resting against the insides of the piles. Piles sheeted in this way to the required depth may be sunk pair after pair at each side until the chasm is closed; always taking care that the sides of the crevass for some six or eight feet at each side of the dam be protected by sheeting piles. It may be found necessary to sheet the piles on the inside as well as the outside. For this purpose a number of wrought iron screw-bolts should be fitted into each pile, the head resting on a wrought iron plate at the outside and the screw point projecting beyond the inside for the necessary length. When the piles have been driven home, sheeting may be secured to them on the inside, always placing a washer under the nut. As each tier of inside sheeting is bolted on, thebottom being cleared out for ten or twelve inches, tough clay well puddled, is to be beaten in between the sheetings. In greater depths than nine or ten feet, an additional row of piles would be necessary, these to be driven first and secured by waleing pieces to the outside row.

When the dam is made across the chasm the embankment is to be carried up in the usual way, and proportioned in the ratio of the force exerted against its several parts. The minimum force is at the water line, the increase going on in an arithmetical progression until the force becomes a maximum at the bottom. This defines the inside slope of an embankment resting against piles as a slope of one to one. The specific gravity of earthwork may be taken at one-third more than that of water; and therefore this embankment is more than an equivalent for the resistence of the water at its face; but the difficulty of making it perfectly water-tight coupled with that property of water by which a vertical film, ever so thin, insinuating itself into the body of the embankment, exerts the same pressure on the portion within it as the total pressure on the face of the dam, requires that a wall of tough clay, free from vegetable matter, well rammed and thoroughly puddled, be carried up from the foundation

to the top of the dam for at least two or three feet thick. The inner slope of the dam, determined by of course the angle of friction of the material employed will contain within it the theoretical slope of one to one, and may be made in practice to commence at such a distance inside the puddling as to offer a resistance equal to whatever multiple of the pressure of thewater may be considered without the limits of safety in each particular case.

In proportioning the materials for the measures proposed above, it is necessary to add only an illustration of the principles already pointed out for the calculation of the pressures exacted: and when these pressures are ascertained in any case, the scantling may be fixed by the usual formulæ for the strength of wrough iron and of timber. As to the strength of canvass we can say nothing further than that we have ourselves used it with great advantage in a longitudinal dam while excavating a shoal under 4½ feet running water. This was probably the first use of canvass in a stank: we are not aware of any other facts as to the strength of that material. Two piles sheeted across and seven feet from out to out when driven, will sustain in a current due to an head of ten feet a pressure equal to 9¼ tons nearly: 7 multiplied by 10 gives a base of 70 feet; and 5 ft. (half the depth) being the height of the column acting on this base gives a body of 350 cubic feet; and this body taken at 62½ lbs. to the cubic foot is equal to a pressure or weight of 21,875 lbs. The pressure on the foot next the bottom is as follows: a column of 9½ feet on a base (7 by 1) of 7 square feet giving 66½ cube feet, shows a total loading of 4156 lbs. or less than two tons. M. B. H.

The Public Works of England.

NO. II.—CANALS.

Continued from page 453.

In the 20 years that followed, up to 1790, the number of canals executed in the country was 17—few of them of equal importance with the preceeding.—Brindley projected the Chesterfield Canal in 1769; it was carried on under his direction and that of his brother-in-law, Mr. Henshall, till its completion in 1776, at a cost of 150,000*l*. Its length is 46 miles, with 65 locks, and one very extensive tunnel, 2850 yards long near Harthill. Mr Grundy had proposed another plan, which would have saved 5 miles, and between 20,000*l*. and 30,000*l*., but Brindley's experience was preferred. The undertaking was a very successful one; but the most important of Brindley's latter suggestions was the Enlesmere and Chester Canal. The famous aqueduct is over the Dee is on this canal carried at height of 125 feet above its bed, on 19 pairs of stone pillars, 52 feet apart. Several others of the great specimens of canal works in the kingdom were of his undertaking. It runs from Elesmere Port to the Montgomery canal, a distance of 61 miles, with numberless collateral branches.—During the progress of this canal the greatest possible difficulty was experienced in raising the money. The shares at one time were sold at 1 per cent. of their original value. The whole cost was nearly 400,000*l*.

The Thames and Severn Canal, another of Brindley's projects, was commenced in 1783. The longest of the tunnels—the Tarleton Tunnel—is on this canal; it is 2¼ miles long. It runs from Stroud to Cirencester, with a length somewhat above 30 miles. The original estimate for the work was 190,000*l*. the actual cost above 500,000*l*.; one of the largest excesses in canal history—and the more strange as their are no branches. It has 40 locks. A union between the Thames and Severn, by means of tne Avon, was another of Charles II.'s projects.

The other canals executed during the period alluded to were the Basingstoke, about 40 miles long, cost about 186,000*l*.; the Erewash, running from the Trent to Langley-bridge, about 12 miles, cost 23,000*l*.; the Cromford, from the Erewash to Cromford, 18 miles, on which are one or two of our finest aqueducts, cost 86,000*l*.; the Bradford, 3 miles long, cost 9000*l*.; the Dudley, of which the original plan was a length of 13 miles, at a cost of 12,000*l*., but the expense of cuts and connecting branches amounted to some where about 150,000*l*. additional; the Market Weighton, 11 miles long; the Andover 22½ miles long, cost 65,000*l*.; the St. Columb, 6 miles long; the Shropshire, a canal of 7 miles from the furnace at Coalbrook Dale to the Severn; the Stourbridge, and three private canals—one executed by Sir J. Ramsden, near Huddersfield, another by Sir N. Gresley, near Newcastle-under-Lyme, and the third by Lord Thanet, a short affair, near Skipton Castle.

After 1790 a violent impetus was given to canal speculations. Between that date and 1795 no less than 43 canals were planned, and acts relative to 15 new undertakings were passed in 1793—the largest number of any year in history. The dates of the first Acts, relative to two of the most important undertakings in the kingdom, the Grand Junction and the Kennet and Avon, belong to this period, being passed, the one in 1793, and the other in 1794. The first of these, one of the most spirited enterprises of the kind, begins at the Oxford Canal, near Braunston to the Thames, at Brenford—a course of 90 miles. The undertaking was the last step in Brindley's grand plan of inland communication through out the country. We had attained already a complete water connection between Liverpool, Hull, and London; but the old river communication, with its tortuous course and manifold disadvantages, still existed in a most important part, that between Oxford and London; and it was to make the canal communication complete that Lord Rockingham, in 1792, employed Mr. Baines to make the survey for the present canal. The first estimate was 600,000*l*.; but, as usual, cuts and extensions require the raising of a further sum of 550,000*l*., making this one of the most extensive undertakings in the kingdom; the length is above 90 miles. There are 98 locks and two tunnels, with several deep cuttings; one near Rulbourne 3 miles long and 30 feet deep for the greater part of the way. There are, besides several embankments—in fact, this, on the whole, came nearer to modern railway enterprise than any work previous to the commencement of the iron age.—From the summit level at Tring to Harefield-park, a distance of about 21 miles, there is a fall of about 300 feet—the height of the summit part being 380 feet above the Thames at Linehouse. The Paddington branch, which is a continuation of the Grand Junction is 34 miles quite level; the water-course for 20 miles, from Paddington to Uxbridge, requiring but a single lock. The greater part of this canal was completed in about 10 years.

The Kennet and Avon Canal—The most important water link between the west and east of the southern counties in England, was commenced in 1794. It runs from the Avon, at Bath, to the Kennet, at Newburn; and, as the former river runs on to Bristol, and the latter to the Thames, a communication is effected between Bristol and London; in fact, between the Irish Channel and German Ocean. It completes moreover the water circuit from the northern districts round the island, and passes through or near several of the most important towns in the south. The original estimate was 570,000*l*.; but a further sum of 702,000*l*. was required to be raised under four successive Acts, to complete the undertaking. The engineering difficulties were in some parts very great. In Somerset and Wiltshire, the country through which it passes is very rugged. At one place near Devizes, a fall occurs of 239 feet in 2½ miles, requiring 29 locks. The length is 57 miles, and the whole rise 210 feet, with 31 locks, and the fall 404½ feet, with 48 locks. The expense per mile (22,315*l*.) makes this one of the most costly canals in the kingdom. As a property this undertaking has been most injured by the Great Western Railway. The company were only enabled to compete with the railroad for the carriage of heavy goods by charging half their prices when they enjoyed the monopoly. The railway at first professed only to carry light goods, and thus disarmed the opposition of the canal, but it has ended, as might have been anticipated, in carrying every thing. One or two of the aqueducts on the canal are of beautiful structure, the Dundas aqueduct especially, which is situated about four miles from Bath.

The number of the works now undertaken prevented the commencement of new designs, and besides the continental disturbances began to be seriously felt. From 1795, to the end of the century, only four canals were commenced—the Grand Western, the Dorset and Somerset, the Newcastle Junction, and the Aberdeenshire. All these, though very useful works, were but of secondary importance. The first-named running from the Exe to Taunton, cost about 330,000*l*.—the length is about 35 miles.—The second was never executed, the third is a very trifling affair, and the fourth only goes to the length of 19 miles: 36 canals have been commenced in the present century, the principal of which are the Regent's and the Caledonia. The larger undertakings were often abandoned, at least in their chief points, which was the case with the Bridgewater and Taunton. The Caledonia, as will be seen, does not pay at all. The Grand Surrey, the original subscription for which was 45,000*l*., but which cost above 300,000*l* additional, pays a very trifling per centage. The Edinburgh and Glasgow, the Macclesfield and the Grand Union, are the three other of most importance. Enterprise was, however, busy about the old lines—most of which received important improvements in this period.

All the undertakings here enumerated have been completed by private persons, either singly or in association. The only work actually undertaken by Government has been the Caledonian Canal. Watt first surveyed this line, but it was carried into execution by Telford. It cuts completely through the Scotch Islands, comeing at the foot of Ben Nevis, and running through three Scotch Lakes to Inverness. The length of the whole is above 60 miles; but very little more than 23 of this is canal, the remainder being lakes. The original intention was to facilitate the transport of Baltic timber, but the traffic has turned out far below the original expectation. The cost to the Government has been above 1,000,000*l*.; and in 1842 the expenditure of wages and maintenance actually exceeded the receipts; the former being 2090*l*.; and the latter 2030*l*. We must add, indeed, 576*l*. of the charges are put down as extraordinary expenditure in building boat-houses, &c.; but, even so, the surplus would be very little above 500*l*. There are 28 locks on this canal, of which a chain of eight, called Neptune's staircase, alone cost 5000*l*. The works of the canal are of first-rate order, and the channel of enormous breadth and depth, as being intended for ship navigation. The width at top is 110 feet; at bottom, 50; depth, 20 feet; the locks 172 feet by 40. All this explains the cost, together with the nature of the country through which the canal passes; but it is an instance of the failure of Government undertakings, as far as mere profit is concerned. Vessels of upwards of 160 tons often pass the canal.—*Daily News.*

Institution of Civil Engineers.

JUNE 19—JOSHUA FIELD, Esq., (President) in the Chair.

The paper read was "On the Employment of High-pressure Steam, working expansively, in Marine Engines," by Mr. John Seaward, M. Inst. C. E.

This communication was described to be the substance of a reply, by the author, to some questions addressed to several eminent engineering firms, by the Hon. H. L. Corry, M.P., when secretary to the Admiralty. This reply was found to furnish so much useful information, and so completely to open the question of the advantage or disadvantage of using high-pressure steam, and of cutting off the steam at various portions of the stroke, that it was conceived it would be advantageously produced at the institution, in order that the subject should be fully discussed. Unfortunately, the absence of the principal members at the floating of the first tube of the Britannia-bridge frustrated the latter expectation, but the substance of the paper appeared to be fully appreciated.

The argument was so continuous that it would be difficult to do more than to give a faint idea of it, as the limits of this account would not suffice for an abstract of it. It first reviewed the mode of working marine engines for some years past, and noticed the gradual change that had occurred, particularly the tendency to use high-pressure steam, instead of that of a pressure of about 4 lbs. above the atmosphere. It then examined the system of cutting off the steam at the various parts of the stroke; and as, at the same time, a remarkable augmentation had occurred in the speed of the vessels,

which was naturally atributed to that cause, it inquired minutely into these several causes and effects as well as the considerable reduction in the consumption of fuel which took place, enabling the vessels, consequently, to make longer voyages, or to carry less fuel for given distances.

In this examination, all the arguments for and against the use of high-pressure steam, and the presumed gain or loss of mechanical power in the use of the expansion principle in the cylinder, were canvassed at length; and the paper wound up with replies of the author to the three questions from the Admiralty, to this effect:—"The highest pressure of steam that we have, in any case, put upon a marine boiler of our own construction, was about 16 pounds to the square inch; but we are not inclined to repeat the experiment, as we feel assured that we can obtain equally good results with steam of a lower pressure—from 10 to 12 lbs. is the usual pressure we employ in the merchant service for engines and boilers of comparative small power. The steam pressure at present emyloved in the service is about 8 lbs. per square inch. We consider steam of this pressure to be well adapted to the exigencies of the service; and we believe it is calculated to secure all the important advantages of power, economy of weight and space, in a very eminent degree; these advantages will, in some respects, be slightly increased by augmenting the steam pressure to 10 or 12 lbs. to the square inch. We strongly recommend that the steam employed in the navy should not be of greater pressure than 10 lbs per square inch, or in extreme cases 12 lbs. to the square inch; any material increase to the latter pressure will be attended with considerable risk, without any adequate advantage."

In the discussions which ensued, these propositions were to a certain extent concurred with, but with limitations as to the introduction of other forms of boilers; and it was explained that the arguments of the paper were only applicable to condensing engines working expansively, and, therefore, left the question of the introduction of the use of high-pressure non-condensing engines quite untouched, and free for discussion at a future period.—*Min. Jour.*

On Gold, and Gold Mines.

BY WILLIAM BIRKMYRE.

No. 1.—General description of Gold.

This metal has been known from the earliest times, and, in consequence of its many valuable properties, has been held by the rudest, and by the most polished ages, in the highest estimation. It is the only *metal* of a yellow colour. There are, however, alloys of copper, and also some minerals—copper pyrites, iron pyrites, and yellow mica—which resemble gold in colour; but their presence at all times is easily detected by chemical tests.

The most prominent of the valuable properties of gold are—1. it is not tarnished by the action of air, coal-gas, water or the common acids, being far superior in this respect to silver, which soon tarnishes by burnt coal-gas and also by the sulphuric acid of its combustion; hence gold or gilt plate wears much longer than silver or silvered plate—a consequence of gold or gilt plate not requiring a tithe of the polishing which silver demands. —2. It exceeds all other bodies in malleability; an ounce troy, which should contain 6 grs. of alloy of copper or silver, is daily converted by the goldbeaters into 1000 leaves, or 40 books of 25 leaves, each being 11 square inches; besides obtaining the above quantity of perfect leaves, there are usually about half an ounce of cuttings. It has been ascertained that gold can be beaten to the 1·492000th of an inch in thickness, 1 grain being, therefore, extended to 100 square inches; it is then so thin as to be transparent to the eye, yielding to it a green colour, which is also true when gold forms a thin coating on glass on being precipitated from some of its solutions.—3. Its *ductility* is such that one grain can be drawn to 500 feet, so that its diameter is only 1·454 5th of an inch, which is sufficiently small for astronomical purposes; but most of the so called gold wire is merely silver gilt, and when used for lace and embroidery, is seldom finer than the 1·500th of an inch in thickness. —4. It excels all other bodies in conducting heat; for if gold be estimated at 100, iron is but 37, lead only 18, and porcelain 1.

The above described-properties of gold, joined to its scarcity in the dark ages, were the chief causes which stimulated a class of persons, known as alchemists, in fruitless attempts to discover what they termed the *philosopher's stone*, or the *elixir*, a substance to their minds sufficient to transmute the commoner metals, or, as they called them, the baser metals, into gold; but the notion almost ceased to be entertained towards the end of the seventeenth century, principally in consequence of the growing intelligence of the people, and also by reason of the great fall in the price of the precious metals, by the discovery of America in 1492. No chemist has been able to prove that this metal is a compound; hence it is universally admitted by them to be one of the 54 elementary bodies in nature.

Gold is found in greatest quantity among the sands of rivers, many of which have been famous in all ages for their golden sands; but none more than the Pactolus, in Asia Minor, from whose bed a considerable portion of the wealth of Crœsus was obtained. Much gold is now procured from mines in primitive rocks especially in Hungary and Brazil. When it occurs in sand the greater portion of this metal is separated simply by washing, without recourse to mercury; but if mined, a great part of the *gold ore* that at the present day is pulverized by stamps driven by water, then treated with mercury in revolving mills, the amalgam being afterwards washed and submitted to heat, by which the mercury is volatalized and condensed in a separate vessel, and in the best conducted establishments with a loss only of one-fourth of the mercury originally employed. The gold now remains freed of the mercury, but usually containing some silver, and occasionally palladium, these three metals being soluble in the quicksilver. There is but a trifling loss of mercury in the extraction of gold compared with that of silver; since the loss hitherto of mercury in the extraction of the latter metal, even in the best conducted amalgimation-works, is four times as great, being due principally to chemical action—the silver ores being generally compounds of sulphur and chlorine, while those of gold are almost invariably alloys, and hence with them the loss is chiefly mechanical.

In the native state gold is never found oxidated or combined with sulphur, like silver, copper, and iron, and, consequently wherever found it has always a metalic lustre; it rarely occurs absolutely pure, and is, therefore, generally found as an alloy. The purest specimens have been discovered in local detritus, or gold sand, but even there it is very impure. Some specimens obtained from sand, and from mines 400 or 500 feet deep, are so unlike gold as to possess a black colour (the *auro preto* of the Portuguese), these contain but 9 per cent. of gold united with other metals, principally tellurium; other specimens are of a white colour (*auro branco* of the Portuguese), and contain about 30 per cent. of gold, combined with silver and palladium.

The metals found most frequently in native gold are silver, copper, and palladium. Gold is generally found in dust, grains, flakes; sometimes in crystals, more or less perfect. It is now obtained in greatest quantity in Russia and in Upper California; the former country last year probably produced £4,100,000, and the latter about half a million sterling; but as the discovery was only made in California the same year, the produce this year is likely to be vastly augmented. Of late years, great masses of gold have been found and recorded in different countries. One of the largest was discovered only 9 ft. beneath the surface of the ground, in the Ural Mountains of Russia, on 7th November, 1842; this mass weighed 96½ lbs. troy, and was, therefore, supposing it to contain 8·33 per cent. of alloy which is the amount in our gold coin, of the value of £4508. 19s. The next largest on record weighed 37 lbs. troy, and was picked up in Haiti, in 1502. A mass was found in 1821 in the United States, which weighed 33 lbs. Another prill, weighing 27 lbs., was picked up at Miask, in the Ural Mountains, where, in fact, many pieces have been discovered, which weighed from 10 lbs. to 17 lbs. nor have the English gold mining associations been unsuccessful this way. The Imperial Brazilian Association discovered, in 1832 at their mine, the Gongo Soco, a lump, which weighed 21 lbs. troy. The greatest specific gravity of a specimen of native gold is 19·099, which contained only 1·48 per cent. of impurity, consisting of silver, copper, and iron; it was brought from near Ekaterinburg, in the government of Perm, in Siberia.—Gold in the native state, and possessing nearly its yellow colour, may be of any specific gravity between 12.666 the lowest yet observed, and 19·3 the highest, which is that of pure gold when simply melted. It is well known to be after platinum, the heaviest body in nature; the specific gravity, 19·3, and yellow colour are almost sufficient evidence of the purity of any specimen of gold. The above specific gravity, of 12·666 clearly indicates that the native specimens must be contaminated with a large quantity of copper; for a mixture of equal parts by weight of silver and gold electrum has a greater specific gravity, and is nearly as white as tin. Many specimens of native gold, but, of course, very impure, have been found as low as 5·7. These possess a white colour, and contain only 30 per cent. of gold, united with 60 of tellurium and 10 of silver; they are generally found in Transylvania. The *lustre* of gold is inferior to steel, silver and mercury; its *tenacity* is less than iron, copper, platinum, and silver; as, in compari-

son, it has but one third the tenacity of iron, and one half of that of copper; or a wire of .078 inch in diameter, will support but 150·07 lbs avoirdupois, without breaking.

The salts of this metal are fully as poisonous as the same compounds of silver.

Pure gold is soft, and not much harder than lead; so that coins made of it wear a great deal faster than when alloyed with copper or silver–hence the utility of these metals in coin.

The gold coins in France and the United States now contain 10 per cent of alloy; while those of this country, since 1604, only contain 8·33 per cent. The relative value to silver at present in *this country* is as 15·98 to 1; but owing to recent great discoveries, and also to political causes in the east of Europe, it is likely to fall greatly in value. The malleability and ductility of this metal are much impared by antimony, lead, bismuth, and arsenic. Thus both properties are almost completely destroyed when gold is alloyed with 1 1920th part of its weight of antimony. When silver or copper are alloyed with gold, the alloy is lighter than the mean specific gravity; hence, unless Archimedes was aware of this fact, he must have taxed the goldsmith who made Hiero's crown with greater fraud than he perpetrated upon the King of Syracuse. There can be no doubt that when gold becomes more abundant very important improvements will be introduced into the arts, more particularly in all that relates to alloys, our knowledge of which being singularly defective.

Gold and copper melt at nearly the same heat; both are fused at 1102·2° Centigrade or 2016° of Fahrenheit's thermometer, while silver melts at 143° less of Fahrenheit.

The best solvents of gold are—mercury, and a mixture of nitric and muriatic acids, *aqua rega*. The former yields a product termed an *amalgam*, which, on being passed through leather, to free it of excess of mercury, leaves a white mortary-looking substance, containing 33·3 per cent. of gold and 66·6 per cent. of mercury. But the usual solvent of chemists is the *aqua regia*; the active ingredients of this compound acid are chlorine and a gas lately discovered by Dr. E. Davy, and called by him the chloronitrous From numerous experiments of my own regarding this compound acid. I am led to believe that the chloro-nitrous gas, as well as chlorine, dissolves gold.

I find that chlorine combines with gold at a high as well as at a low temperature, so that the proposition made in 1841, and published in the *Transactions of the Society of Arts*, to assay alloys of gold by passing a current of chlorine gas over the gold alloy at a red heat, on the supposition that chlorine would only combine with the other metals at that heat, is not founded on a accurate data I found, on repeated experiments, that pure gold itself lost 4 per cent. of its weight on passing a current of chlorine over it, at a red heat, a loss much too great in such a simple matter as an assay of gold. It has indeed, been long suspected by chemists that a portion of gold is volatilized as chloride when its chloride is submitted to heat, the result of the experiments just related go far to confirm the fact. Bromine and fluorin act readily upon gold. Though by far the greater part of the gold consumed in the arts, still retains its characteristic yellow color, unlike copper and zinc in this respect, yet a rapidly increasing quantity of gold is used in the art of coloring glass, in which its color is changed to a deep red. As "purple of Cassius" (oxide of gold and oxide of tin) it has been used in this way, for about 200 years, but of late it has been discovered that the solution of the metal in *aqua regia* equally imparts to glass the superb ruby color.

The combining equivalent is 199·2, and the symbol used by modern chemists to prevent circumlocution, *au* from the Latin *aurum* The alchemists used to designated it *Sol.—Ib.*

Great Girder Bridge on the Manchester, Sheffield, and Lincolnshire.

THE important railway group named above is now rapidly approaching completion; and there appears no doubt that on the 16 of July the southern shores of the Humber on the east, and the Mersey on the west coast of England, will be directly connected by this complete group of lines, including Sheffield, Manchester, Lincolnshire, and Hull. The only work of magnitude remaining to be completed is the great bridge over the Trent at Gainsborough; and, by a curious coincidence, in the present week, and, if we mistake not, the very same day on which the Britainia Bridge was being fixed in its final resting place, the last link of this great line of communication was being completed, and completed by an iron link of the same nature as the Britainia, though on a much smaller scale, and, in fact, one of the numerous progeny of which it is like to be the parent

This last link of the great east and west group of railways is a bridge of similar character, but of smaller dimensions, which is now being moved over the River Trent at Gainsborough, by totally different and peculiar mechanical appliances, but intended to accomplish the same purposes. This bridge is called a *hollow girder bridge*, to distinguish it from the hollow tubular bridge, and is of the largest dimensions yet executen of that construction. It differs from the Britainia and Conway bridges in this respect, that instead of the trains running through the inside of the tube, the girders form the parapets of the bridge, and the roadway is supported by transverse wrought-iron hollow beams, also of the tubular construction.

This bridge has been designed by Mr. Fowler, the engineer of the line, and the girders are executed by Messrs. Fairbairn, of Manchester. The stonework consists of a centre pier and two handsome elliptical arches of 50 ft. span, terminating by substantial and appropriate land abutments. The masonary has been executed by Messrs. J. Stephenson and Co., the contractors of this part of the line. The iron part of the structure consists of two spans of 154 ft. each, which with the two land arches and abutments, give a total length of about 460 ft. The dimensions of the principal girders are each 336 ft. long, 12 ft. high, and 3 ft. 1 in wide. The tops of the girders are formed of two cells, 18 in. wide and 12 in. deep, to resist compression, and the bottom of double-rivetted plates, to resist tension. The girders are fixed securely on the middle pier; on the land abutments their ends are supported upon rollers resting on cast-iron plates, bedded into the masonary, to admit of expansion and contraction. On the outside of the girders are rivited two parallel lines of angle iron, in tne form of an arch, which spring from the middle pier to the land abutments on each side, and give a symmetrical appearance to the structure. The weight of the iron-work in the bridge is as follows:—The two principal girders each, 150 tons = 300; transverse beams, 4 ft. asunder, 82; cast-iron, 10; total, 392; or about 400 tons. It was originally intended to have them constructed on a platform or scaffolding supported upon piles driven across the bed of the river; but the depth of the water, the nature of the ground, and the necessity of preserving the navigation open, render such a process in admissible. Subsequently it was determined to construct them at one end of the embankment, and to haul them across upon rollers from one side of the river to the other; but much greater difficulties have been encountered than were originally contemplated, as the immense weight of the girders, when resting upon a comparatively few points of support, caused the embankment to settle, and much time and trouble were expended before it was sufficiently consolidated to bear the load.

The process of hauling the girders without any intermediate support, excepting a roller fixed upon piles at a few feet from the middle pier and last abutment, was a formidable undertaking. In this operation one end of the girder had to be suspended 120 feet before it received the auxiliary support. These operations were, however, successfully accomplished under the direction of Mr. Fowler, the engineer, and Mr. Fairbairn, the contractor; and the first girder now rests in its place, and is likely to remain as another monument of English engineering skill. The second girder, with all the ways and rollers fixed, is now ready for moving, and a few days will, no doubt, find it equally secure with the first; and in less than a month from this time we may confidently expect to witness railway trains passing over the bridge in perfect security, and to the great convenience and advantage of the immense agricultural and commercial population destined to be benefitted by the completion of the Manchester, Sheffield, and Lincolnshire Railway.—*Railway Chronicle.*

Central Ohio Railroad.

In view of the very general desire to know the precise situation of this project at present, we take pleasure in laying before the public the following statement, for which we are indebted to Col. J. H. Sullivan, the President of the Company.

It is proposed to build first, that division of this work which lies between Zanesville and Columbus, for which subscriptions are now being made.

The estimates of the cost, are as follows:

J. Knight Esq., says "the probable average cost of the graduation, masonary, and bridging of a width for *two tracks*, from

Zanesville to Columbus, would be $5,000 per mile" which for 60 miles amounts to	$300,000
Superstructure—Heavy rail and laying, by Capt. Childe's estimate—$8,000 per mile for 65 miles including sidings	520,000
Depots, water stations, turn-tables &c., say	50,000
Locomotives, passengers, burden and gravel cars, outfit for the Road	80,000
Add for right of way and contingencies	27,000
	$977,000
It is assumed that, to provide for the rail amounting to	$422,500
And the outfit of the Road amounting to	80,000
And in the aggregate	$502,500

A loan could be effected on the Bonds of the Company. This amount then deducted from the gross cost, would leave but $475,500, to be furnished by subscriptions to the stock of the Company.

To provide this fund, it was suggested that $500,000 be raised in the three counties of Muskingum, Licking and Franklin, in the following proportions, viz: in Muskingum $300,000; in Licking $100,000 and in Franklin $100,000.

We are pleased to learn that so far as Muskingum is concerned the question is settled. We have now a subscription list of $175,000, which, with the law authorizing (upon a favourable vote) an additional subscription upon the part of the county of $90,000, and upon the part of the town 20,000, brings us within $15,000 of our complement. As some of our larger property holders have not yet subscribed, we are confident that their sense of what is due to the community in which they have made their wealth, will induce them to come forward promptly and foot up the last.

Feeling confident of this result a meeting of the Board of Directors is called for Friday next, when it is intended to recommend the organization of an Engineer corps for *immediate* service. The labour indicated for them will probably be the survey of all the routes between this and Columbus; and it is hoped that by the time the surveys are completed the whole of the stock required will be subscribed, so that a location of the line can be made and the letting of contracts had sufficiently early this fall to justify the opening of the work.

So far as the $200,000 expected from Licking and Franklin is concerned, we have understood that the feeling in those counties is very kindly towards the enterprise, and as the have the *ability* to do their share, we cannot doubt of their ready co-operation.

Zanesville Courier.

AMERICAN RAILROAD JOURNAL.

Saturday, July 28, 1849.

St. Lawrence and Lake Champlain Canal.

At a meeting held in Troy on the 20th instant to take into consideration the project of uniting the waters of Lake Champlain and the St. Lawrence, by a ship canal of the same dimensions of the Welland and St. Lawrence Canals, Gen. Wool presided, and A. K. Hadley, Esq., acted as Secretary.

John Young, Esq., of Montreal, presented a memoranda of a survey of the proposed canal made by J. B. Mills, Esq., by order of the government of Canada. Leaving St. John as the southern terminus, it follows the line of the Chambly Canal to St. Therese, 8¼ miles, thence it turns northwesterly, and strikes the St. Lawrence near the village of Caughnawaga.

The canal keeps the level of Lake Champlain till within three miles of the St. Lawrence, from which point it descends 29 feet by two locks to the river.

The whole length of the canal will be about 32 miles, and its estimated cost $1,438,568.

Mr. Young presented the meeting with a long memorandum to show the amount of business that might be expected to pass over the canal if constructed, which we deem unnecessary to give. We cannot doubt that a large amount of the produce of the west would take this route in preference to any other. The construction of this work would lead to the construction of a ship canal from the Hudson to Lake Champlain, so that vessels of 3000 barrels capacity could load at any Western lake port direct for New York city.

A committee consisting of Timothy Follett, of Burlington; G. L. Schuyler, G. M. Davidson, L. G. Cannon, Jonn T. Cooper, H. H. Russell, Gen. Wool, and James Titus, of the State of New York; and Nathan Rice, B. T. Reed, and John Howe of Boston, were appointed to visit the site of the proposed canal, and obtain all information relative thereto in their power; and the meeting adjourned till the 21st of August next to meet at the United States Hotel, Saratoga, to hear the report of the committee.

Baltimore.

We are indebted to a friend, for the following interesting facts, in regard to the improvements going on at Baltimore.

In the early part of this year, the "Baltimore and Ohio Railroad Co.," finished the construction of their branch road to "Locust Point," and also their extensive wharves now known as the "Locust Point Depot," This place situated on the South side of Baltimore harbor, immediately opposite "Fells Point," one of the oldest and most thickly populated parts of the city, may now be considered as the grand terminus of this great thoroughfare, destined, with its connections, in a short time to reach from the Atlantic to the Mississippi. It is already far advanced towards completion to the Ohio river. The cars have for a long time been in successful operation to Cumberland (179 miles.) The immense amount of freight collected upon the line, and destined to the seaboard, rendered it almost impossible for the company, with their old arrangements, to dispose of it; and as the coal trade grew in importance, and called for greater accommodation than the company were able to give, they with commendable zeal constructed and finished the Locust Point terminus, which, at no distant day will, I have no doubt, be the depository of all freight destined for a foreign market, or for transhipment to our own neighboring ports. The terminus is on the northern part of a peninsula formed by the harbor of Baltimore—another inlet called the Spring Garden—and the Patapsco river. This point was in the first instance the proper locale for the city; and would, from its natural advantages, have been so, but the owner of the ground utterly refused to sell any portion of it.

This great error is now about being corrected, as the property has fallen into the hands of parties able and anxious to develope its natural advantages.

The railroad wharf here is truly a great work.—It was constructed with cribs filled and sunk, leaving the depth of water along side 22 feet, and with its superstructure forms an imposing and sightly structure. The wharf lot has an area of about 8 acres, and has an accessible water front of 2000 feet. The grounds are reached by means of numerous ground tracks, and the wharf by three tracks located on trestle work 14 feet high, arranged with coal shoots in such a manner that the coal is transferred directly from the cars to the hold of the vessel without the least handling. Several ships of 750 tons, have lately loaded at this place, destined for the Panama coast—the superior quality of the Cumberland coal and its cheapness, rendering it a desirable fuel and fully justifying that long voyage. There are generally from 15 to 20 vessels loading here, and so great are the accommodations, that from 4 to 500 tons have been loaded in a vessel in a day.

The demand for this coal is constantly increasing, and the facilities at present afforded are scarcely sufficient to meet it. The great increase in the demand for this coal is not surprising, when we consider that it is entirely free from sulphur and weighs 84 pounds per bushel, and is found to be superior to any other fuel, for ocean navigation.

The wharves and their appurtenances reflect great credit upon the persons engaged in their location, and construction. This I was given to understand, was done entirely by the Officers of the Company, thus fully certifying to the capabilities of the Engineering Department of the road, the chief of which has been long and favourably known as an Engineer of high standing.

There are already upon the point several important Iron manufacturers or brass furnaces; the principal ones belonging to the Messrs. Ellicott.

These furnaces, notwithstanding the great depression of the Iron market, are weekly turning out a large amount of Iron, of a superior quality. On the North-west side of the terminus is a large square, adjoining the Messrs. Ellicott, at present being improved by some gentlemen, to me unknown. On the South side, are the extensive works of the Baltimore, and Cuba Copper Smelting company, now turning out $250,000, worth of copper per year.—This Company is also at present busily engaged, in constructing extensive rolling mills, for the purpose of manufacturing copper into any shape that may be required. This is almost a new business in this county, and the traveller of leisure will be well repaid by a visit to these works.

They have also constructed a number of neat and substantial brick dwelling houses for the accomodation of their hands, as well as a new church to keep everything in order.

A Steam ferry is shortly to be put in operation, connecting this point directly with Baltimore city, at Fells Point, (and there connecting with the various omnibus lines to all parts of the city), the distance across the ferry being about ¼ a mile. This point, from its natural advantages, and near relation to the city, as well as its proximity to the iron ore regions, and the great cheapness of fuel, must in a short time become the manufacturing portion of Baltimore. The Cumberland coal is delivered here at $3 70 per ton, and wood of the best quality from the Chesapeake bay at $2 25 per cord. The supply of wood is as inexhaustible as the supply of coal; for the shores of the beautiful bay and its tributaries, from whence the supply is drawn, comprise an extent of 4,000 miles.

To this abundance of fuel, Baltimore is already indebted for much of her prosperity, and will also be indebted for her future prosperity as a manufacturing city. Should sufficient protection be afforded to the manufacturing iron interests, by our government, at the next session, we shall in a few years see Locust Point covered with extensive manufactories, and with a busy population forming part of Baltimore city.

R.

Macon and Western Railroad Company.

This company has declared a dividend payable on the first proximo, of $2 50 per share. Its earnings for the past six months ending June 30 have been $115,748. The latest sales of stock have been at $50 per share.

☞ For the future we shall insert our "*Share Lists*" monthly instead of weekly, as heretofore.

☞ Railroads in want of a "*Turn-Table*," will find one advertised in our paper.

A Trip on the New England Railroads.

Vermont Central Railroad.

BOSTON, JULY 20, 1849.

Though not having "*a stockholder's ticket,*" I was inclined to take the occasion of the annual meeting of the shareholders in the Vermont Central road on the 18th inst., for the purpose of visiting the renowned capital of Vermont. The strong interest excited by the event of the meeting, seemed to augur the display of some feeling on the occasion among the stockholders. There is no concealing the fact, that a strong feeling of jealousy towards those who have managed this road is growing up throughout the State of Vermont, though its shareholders, who mainly reside in Boston, seem to regard them with very different emotions.

Boston is aiming to extend an unbroken line of railway to the St. Lawrence river, at Ogdensburgh, crossing the outlet of Lake Champlain by a bridge. The Legislature of Vermont declined the grant for this purpose principally through the influence of Burlington, and the friends of the Rutland and the Passumpsic roads. The Legislature of New York has adopted a similar policy. Business thrown upon Lake Champlain naturally reaches Burlington, the chief town upon the Vermont side, and something is likely to be deposited in the coffers of her people from the proceeds of this trade. Allow Boston to load her cars at Ogdensburgh, and run them across Lake Champlain and Vermont, without transhipment or delay, and Burlington loses its importance at once. So also does Plattsburgh and Whitehall.

When the claims of the two rival lines to Burlington, the *Vermont Central* and the *Rutland* roads, were presented to the consideration of the Bostonians in 1845, many were surprised at the result of their efforts. The Central apparently outstripped its rival in the race, and seemed destined to extraordinary success; and it was confidently asserted that the entire line to Burlington would be opened for travel during the year 1847.

The Vermont *Central* has filled a more conspicuous place before the public for the last four years than any New England road, owing to a variety of causes too well known to need repetition. We read the earlier discussions carried on by the friends of these rival enterprises in the Boston papers in 1845, and have kept an eye upon their progress since.—Notwithstanding the discouragements thrown in the way of the Rutland road, the chances are that it will reach Burlington as soon as the Central can be completed to the same point. The stock of the Rutland road is worth some 75 dollars per share, and is principally held by the people upon its line; that of the Central is largely owned in Boston, and now sells for 46 and 47 dollars per share. The feeling in Boston favors the bridging of Lake Champlain.—The directors of the Rutland railroad have been opposed to this measure from the first. This fact explains the peculiar history of the two companies.

Leaving Boston at 7½ A.M. on the 17th, we found our train of 17 cars well loaded, and the number continued to increase by fresh accessions of shareholders till we reached Montpelier, some two hours or more behind the usual time.

I had never before passed by railway from Fitchburg to the mouth of White river. I was forcibly struck with the appearance of the work, so formidable was its character the whole distance. The Cheshire road especially excited admiration. Such long cuttings through the most obdurate rock formation, can no where else be found in New England. The sides of the rock were cut smoothly down, and the water courses finished with solid masonry, giving it an air of thorough workmanship, which no other road in the country can boast.

On the Sullivan road we cross Sugar river near Claremont, on the top chord of a bridge *ninety feet* above the water; and from *Windsor* to the mouth of *White river* the work for a large portion of the distance is heavy and expensive,

From the mouth of White river to the Summit at Roxbury, the grade of the road is clearly perceived in the diminished speed of the train; and from the summit to Northfield, 6½ miles, the descent is such that the force of gravity alone carries the train the whole distance. The whole ride from Fitchburg to Montpelier presents a succession of shifting scenes, more varied and beautiful than any route of equal length that I have travelled. Monadnock mountain and Kearsarge on the one side, and Ascutney on the other, swell up from the plain over which you are passing in majestic grandeur, while the narrow valley of the Connecticut, as you enter it at Westmoreland, seems to terminate abruptly by the sloping hill sides, which bound the prospect on every hand.

The cars on this line are all new, of modern finish, with footrests and high-back seats, contrasting favorably with the equipment on the Concord railroad. Narrow, poorly ventilated cars; with old fashioned low-back seats; destitute of foot rests, or the ordinary comforts required on the newly built roads, are still inflicted upon the travelling public between Concord and Boston. It is to be hoped that the completion of the new lines from Concord to Boston and Portsmouth will bring good manners and obliging conductors into more prominent use on the old 10 per cent. paying roads.

The meeting at Montpelier on the 18th was literally immense for such an occasion.

Gov. Paine, president of the company, took the chair, and E. P. Walton, Jr., Esq., of Montpelier, secretary of the company, read the reports of the directors and treasurer.

It appears by the statement of the treasurer, tha the total amount standing to the credit of the company on his books is.....3,982,701 01

In this sum is included the loan of 1847.....	297,300 00	
From which was realised..	288,600 00	
Leaving to be deducted.....	8,700 00	
There is also included the sum of interest credited to the stockholders.....	128,274,76	
Making a deduction of.....		137,374 76
Leavng.....		3,845,326 25

as the amount received from all sources by the company.

Of this sum there have been expended the following items, not properly chargeable to the cost of the road, viz:

Vermont and Canada railroad company.	1,049 13
Winooski turnpike.....	18,000 00
Stock in Grand Junction railroad co....	100,000 00
Fuel.....	11,833 53
Shop work.....	5,365 16
Running expenses.....	4,139 30
Interest.....	282,384 46
Do. on bonds.....	93,304 00
Cash deposits and stock in Boston and Providence railroad.....	73,437 32
	519,512 90

Which being deducted from the amount of cash received, leaves 3,325,813 85, as the sum actually expended in the construction of the road to 1st inst.

It further appears from the treasurer's statement, that the debt of the company on the 1st instant consisted of

The loan of 1847.....	297,300 00	
Notes payable.....	327,322 39	
Outstanding bills.....	33,531 05	
		658,153 44
And that the assets were :		
Assessments due on old stock.	252,329 32	
" " new "	55,959 33	
Cash in hand, deposits, and Boston and Providence R. R. stock.....	73,437 32	
		381,725 97
Leaving as debt of company.....		276,427 47

To meet this debt and raise funds sufficient to complete the road, the directors on the 9th of July authorised the issue of new stock at 50 dollars per share, to the amount of one million dollars. If the directors had waited for the judgment of the stockholders in this matter, it would have prevented the completion of the road during the present year, and been a serious injury to the interests of the road and the public.

The railroad was opened for passenger travel between the White River Junction and Bethel, Vt.—a distance of 25 miles—on the 26 of June, 1848, and for freight on the 10th of July following. On the 7th September, cars were run to the summit in Roxbury, 46 miles, and to Northfield, 53 miles, on the 10th October, the same year. On the 13th of February, 1849, passenger cars were run, for the first time, from the White River Junction down to Windsor, Vt., 14 12 miles. On the 20 June, the road was opened for passengers to Montpelier, and the first locomotive entered the capital of Vermont on that day. The distance from Northfield to Montpelier is 10 miles. the whole length of the road now in operation, therefore, is 77 1-2 miles.

The Engineer reports that there is required to finish the road to Burlington, $830,000, which will make the whole cost of the road, $4 155 818 35, or $35 795 per mile (116,1-10 miles), an excess of 5000 dollars a mile over the original estimate.

Of this excess, nearly one half is chargeable to land damages alone, of which $182,465 has already been paid, including the purchase of the Winooski Turnpike; and there remains to be paid, $49 636 42. This may seem a large amount; but the line of the road passes through the best meadow lands in the valleys of the Connecticut, White and Winooski rivers, and in several instances it has been deemed good economy to purchase farms, wood lands and other real estates rather than submit to unreasonable demands for right of way and depot grounds. From the sale of such portions of this property, as may not be wanted, ultimately, it is thought there may be realized 25 or 30 thousand dollars. Another item of increased expenses has been the superiority of the Bridges, which have exceeded the original cost by about 100,000 dollars.

The location of a portion of the road in the valley of the Winooski River has been altered since a portion of the grading was done. When the original location was made, it was deemed impracticable by the Engineer who located it, to turn the river from its old into a new channel. This opinion has been found to be erroneous. At one point the experiment has been already tried and found to be successful. To avoid the river, the original location was necessarily circuitous and undulating, and involved the expense of several heavy rock cuttings. The object of the new location, was to make a straighter, shorter and more level road. The expense of building the new will be no greater than that of finishing the old.

The grading, masonary and bridging on that portion of the road between Montpelier and Middlesex and Waterbury, is progressing vigorously to completion.—The rails will be laid to Middlesex early in the month of August, and to Waterbury in September next. Most of the work remaining unfinished on the line to Burlington has been relet since the first instant., on favourable terms for the company. The contractors are at work upon it, and the whole may be soon finished (with the exception of the two rock points around which a track may be temporally laid) to the East end of the tunnel at Burlington.

The Business of the road, during the year ending June 30, was as follows:

Whole number of passengers.....	47,095
" " tons of freight.....	25,074

Income.

From passengers, gross receipts	48 466 12	
" Freight, " "	44 616 12	
" Express, to June 1	528 34	
		$93,610 58

Expenses

Fuel, Oil and waste	6,812 66	
Salaries, repairs of engines, and incidental expenses chargeable to passenger department	9,459 69	
Do. do. charg. to freight depar't.	11,136 82	
Gratuites and damages	75 00	
		27,484 17
Net earnings		$66,126 41

Which is 4 45-100ths per cent. upon the capital expended upon the portions of the road that have been operated.

The Reports were accepted and ordered to be printed.

On motion of Mr Nesmith, President of the Northern road, the time for stockholders to subscribe for new stock was extended to the first of August.

The Company then proceeded to the election of Directors, when it was announced that Drs. Adams and White and Mr. Spaulding, declined being candidates for re-election. A committee was appointed to collect the votes for Directors, which made the following report.

Whole number of votes	11,700
Of which Charles Paine, Northfield, had	10,951
James R. Langdon, Montpelier	11,327
John Peck, Burlington	11,162
Joseph Bell, Boston	11,530
Franklin Haven, do.	11,655
Thomas Gray, do.	11,287
Gardner Brewer, do.	11,426

The remaining votes were scattering. After the election was declared the meeting was disolved.

The directors of last year were Gov. Paine, R. G. Shaw of Boston, John Peck, Daniel White of Charlestown, Mass., Isaac Spaulding of Nashua, Horatio Adams of Waltham, and Isaiah Silver of Montpelier.

I have taken the trouble to compare the reports of the present year with those of the last.

The directors last year said, "the board entertain a confident expectation that the whole road will be completed at a cost within the sum of about $31,000 per mile: such also is the opinion of the engineers." (pp. 6, 7.) This would make the cost of the road (116 1-10 miles) about $3,600,000.

It will be seen above that the estimate of the engineer now calls for 4,155,813 35, or at the rate of 35,795 per mile.

There was due on the old stock last year (19,966 shares) the sum of		$259,882 50
This year the sums returned as due on same is	252,329 32	
Showing collections amounting to	7,553 18	
during the year.		
The debts of the company in 1848 were	668,748 00	
Do., present year	658,153 44	
Showing a reduction of debt of	10,594 56	
The money received to July 1, 1849, is		3,845,326 25
Do., according to report of 1848		2,331,039 50
Showing the receipts the past year	1,514,286 75	

To realise this sum the past year a sale of shares has been resorted to. This course will bring the cost of this road up to a large nominal sum above the estimated cost. The directors do not state the number of shares issued.

According to our calculation the road will stand as follows, viz:

Old stock paid to July 1, 1848	1,636,117 50	
" " since	7,553 18	
		1,643,670 68
Received by loans on notes, etc.	658,153 44	
Leaving to be raised by sales of stock.	1,543,502 13	
Amount received		3,855,326 25
Add to this sum, for loss on stock sold at 50 dollars per share	1,543,502 13	
Add to this the sum required to complete it	830,000 00	
Loss on stock	830,000 00	
Capital stock required to complete the road will be		7.048,828 38
Of this sum 658,153 44 dollars is a debt which cannot be paid off in stock, except at the market price.		
Add to this sum	658,153 44	
And the capital required to represent the cost of this road is		7,706,981 82

This estimate is based on the supposition that only 830,000 dollars more are required to finish the road, and that the old stock on which 252,329 33 is still due will not be realised.

This will make the cost of the Central railroad equal to 66,000 dollars per mile, or about on a par with the cost of the Western railroad. VIATOR.

For the American Railroad Journal.

Iron Steam Boilers, vs. Copper Boilers.

It has been for many years, and still is, the practice of scientific men, to recommend copper in preference to wrought iron, for boilers to heat water or other fluids, on the ground of the superior conducting power of the former over the latter metal; and it will doubtless appear strange to many, that a doctrine so well established should now for the first time (known to the writer,) meet with the most unqualified dissent. The superior conducting power of copper over iron admits of no doubt, and yet, upon this confessedly correct basis has been raised the most fallacious doctrine the whole range of scientific engineering of the present age can produce. It is scarcely possible to imagine the enormous amount of money wasted, and worse than wasted, in this country alone, by the use of copper instead of iron in the boilers of steamboats, to say nothing of locomotives. Four boilers were recently put into an United States steamer, which cost $120,000, and weighed 140 tons, while iron ones, according to Prof. Renwick, would have cost only $34,000, and have weighed only 82 tons; thus, in addition to the $86,000 useless first cost, there is an useless weight of 58 tons also.

That such an enormous outlay should be sanctioned, may well excite surprise, founded, as it is, upon an engineering blunder, did we not remember another which kept its ground for some time in England, the much valued invention of Blenkinsop, in the early days of railroad engineering.*

In the case with these and many other boilers, (more particularly government ones,) the heaviest dearest and weakest material is employed, for reasons, which, sooner or later, must appear, too childish to be entitled to notice.

The experiments which have been made, proving that copper is a better conductor of heat than iron, are principally those of M. Brot, and M. Despretz. On a bar of each metal metal being plunged into a bath of mercury or of molten lead, it was found that although the temperature of each was of course almost if not absolutely identical, at the smallest appreciable distance from the bath, that the copper, being the best conductor of heat, kept it to itself, or would not readily part with it, while the iron was an inferior one in conducting power, in consequence of parting with it more rapidly; the term "good conductor" has therefore been applied, erroneously, because it was intended to convey the idea that it would convey or conduct the heat or caloric of the fire, throu gh itself, into the water, on the other side; which does not apply the copper but to iron; which is confirmed by the facts which are well known, *that the absorptive and radiative powers are always equal in the same metal*, and are far greater in iron than in copper, while the latter metal is in the same ratio the best reflector; for, *reflection is inversely as radiation*, as proved by Leslie and others. The power of reflection then, appears to control that of radiation, &c., &c, confine the caloric within the metallic (copper) surfaces, or at least within that depth in which the power of reflection lies.

With these facts before us, together with others proving beyond a doubt that all other things being the same, more water is evaporated in the same space of time in iron than in copper boilers, with the same amount of fuel; it is not possible that the present absurd and fallaceous arguments can stand another year; and their downfall must be hailed with pleasure by all who love the truth, and progress, and Science, and will enevitably lead to the perfecting of boilers, made of that still *most noble* of all the metals, *iron, glorious iron.*

Copper being a better reflector than iron, is then, in consequence, inferior as an absorber of caloric, and for the same reason also as a radiator, but superior as a conductor, that is, as a retainer; for it appears that it is difficult for the caloric to get into copper, (as compared with iron,) and equally difficult to get out of it again when it has once got in, and therefore it expands within it, so that in a locomotive boiler, with copper tubes of a moderate length, the end of the tubes next the smoke box, may be conveying away the heat from the end next the furnace; a state of things which it behoves our railway engineers and directors to look after, as one of the elements of extravagance, in that most economical boiler: Iron tubes of half the length would extract more of the caloric from the burning fuel, and it is only because they are of copper, that it is necessary to make them so long.

Iron absorbs heat so much more rapidly than copper, that many explosions have occurred which would not had copper been used; although this is admitted, it is a little too bad to praise copper for this also, that it will not let a boiler blow up, when every thing considered, it ought to blow up, if a good fire and a good medium through which to convey its calorie into the water, have any virtue in them. Copper cannot be a good medium thro' which to raise steam and a bad one to blow up with; that is rather too much, yet the argument means this if anything, nevertheless, it is admitted that this is not the ground on which any dependence can be placed, because, whenever such a catastrophy has happened it has arisen from a defective arrangement of the boiler—in fact, the *greatest defect* that can properly occur in the designing of a boiler; the want of *a complete and thorough circulation of the water within it*, on precisely the same principle as the circulation of hot water in pipes, for the purpose of warming buildings. No boiler of such a construction as here recommended ever blew up from the cause alluded to, as it is well known that water is a far better conductor of caloric than any

* This invention consisted in placing cogs upon the rails and wheels, to get a foothold, as it were, having first assumed that the "bite" would not be sufficient to prevent the wheels going round without moving the carriage forward.

metal, in the proportion, (according to the experiments of Mr. Sparkes of England,) of about 26 to 10. T. A. R.

For the American Railroad Journal.

Alexandria and Baltimore.

In a trip recently made to the old dominion, (Virginia,) I took occasion to stop a few days in the good city or village of Alexandria. I found the people of that portion of the country fully alive to the great importance of railroad matters. The Virginians are truly waking up after a long rest, and with the help of a liberal policy adopted by the Legislature of Virginia at the last session, will soon be in the front rank of the internal improvement states. The inhabitants of Alexandria and its vicinity, participating in the general railway mania that at present prevails all over Virginia, and having secured the construction of the "Orange and Alexandria railroad," running from Alexandria to the Louisa railroad at Gordonsville, to which the state subscribed $540,000, are again in the field holding meetings in the back country and endeavoring to urge forward the Alexandria and Valley railroad. This road to which the state also subscribed $1,250,000, is intended to branch from the Orange and Alexandria railroad some distance from Alexandria, and to reach the Virginia Valley; (the garden of the United States,) by crossing the Blue ridge, through the "Menasses Gap" the only place where the formidable barrier can be crossed without a long and expensive tunnel. At this place however a railroad can cross with grades not to exceed 70 feet per miles—and perhaps less.

The spirit and energy at present prevailing in Alexandria will, if continued, ultimately succeed in bringing to that place her full share of the immense trade of the village and render her more prosperous than she was in her most palmy days.

The inhabitants of Washington and vicinity are apparently perfectly satisfied with their railroad to Baltimore, and a ditch or canal through the city.—This however is not the case with the Baltimoreans. They are urging forward their Baltimore and Ohio railroad towards the Ohio as rapidly as possible.—They have already pushed the Baltimore and Susquehanna, the York and Maryland line, and the Wrightsville, York and Getteysburgh railroads, which, with the York and Cumberland road now in course of construction, will give them two intersections with the great Pennsylvania Central railroad. They have also a direct railroad communication with Philadelphia on the north and Washington on the south.

Not content with these great railroad connections, they, (fully alive to the value of the trade of the mighty west, that they have long struggled for,) are now endeavoring to move the construction of a continuous line of railroad directly up the valley of the Susquehanna to Williamsport; there to connect with the Williamsport and Elmira railroad, (26 miles of which are already finished,) thus forming a direct communication with the New York and Erie railroad at Elmira. This connection when formed will give to Baltimore an advantage over New York in point of distance that the New Yorkers little think of—as by this route Baltimore is 55 miles nearer Lake Erie than New York. The distance from Baltimore to Elmira being but 248 miles, while the distance from New York to the same point is 303 miles. The people of Baltimore with this connection will I have no doubt divert a large portion of the trade and travel direct to Baltimore, that would otherwise flow to New York.

The Depot of the Baltimore and Ohio railroad is shortly to be changed to the present locomotive terminus, thus doing away with the enormous tax upon that company for horse power which is necessary now to bring their cars to the Pratt street depot.—This change when effected cannot fail to be of great advantage in a pecuniary point of view to the company. The Baltimore and Susquehanna railroad company are also about doing away with their horse power, which is at present required to bring their cars from the locomotive terminus at Bolton to the interior of the city and *vice versa*. They have procured from the city authorities permission to come into the city with locomotive engines, and have in consequence procured a large block of land lying almost in the heart of the city. This block they are fast covering with an immense freight and passenger depot (built cornerwise of the block,) which, when finished will be one of the largest and most imposing railroad structures in this country.

The building alone, I am informed, will cost about $80,000, and is to be constructed of brick, granite and freestone. The company are also procuring an engine expressly to surmount the heavy grades in North st., which will transport all the cars, both freight and passenger, from the new terminus or depot, to the present locomotive terminus at Bolton—this engine to run backwards and forwards between Bolton and the depot only—thus avoiding entirely the present expensive horse power.

A spirit of energy prevails among all the business men of this city that is truly gratifying to observe. I have this day visited several of the machine shops in this city, the principal one being the old and widely-known locomotive establishment of Ross Winans, Esq., the extensive works of A. & W. Denmead & Son, the works of Messrs. Pool & Furgersen, and the Vulcan Works of Messrs. Murray and Hazlehurst. They have all apparently as much work on their hands as they can well attend to. This alone speaks volumes in favor of the prosperity of Baltimore. Among the various engines in course of construction at the different places, I noticed at the works of Messrs. Murray & Hazlehurst a pair of large oscilating engines for the new steamers to ply between this city and Charleston. These are I believe the first oscillat- engines of large size ever constructed in this country. The cylinders are 74 inches and 10 feet stroke. if they fully succeed, of which they have no doubt, these gentlemen will have the honor of constructing the first engines of this kind of large capacity ever built here. I also noticed at their works some large machinery being constructed for the new government steamer now building at Norfolk.

The various and almost innumerable forges and blast furnaces in and around the city look prosperous, and the basin and its vicinity look as if Baltimore had at least her share of the business of the Atlantic coast. R.

Improved Railway Wheels.

[Specification of a patent granted to William Wharton, Superintendent of the Carriage Department of the London and North Western Railway Station, Euston square for certain improvements in the construction of vehicles to be used on railways, or other roads and ways. Inrolled, June, '49.]

The patentee, in his specification of these improvements, thus sets forth the nature of his invention: The first part of my invention of certain improvements in the construction of vehicles used on railways, or on other roads or ways, consists in a new mode of constructing the wheels of such vehicles. The construction of the wheel is as follows:—Into the boss, or nave, the ends of curved wrought iron spokes are cast, or, in some cases, it may be found desirable to form the nave of wrought iron, the spokes are connected to a wooden felloe, and to the tire of the wheel, by countersunk bolts and nuts; and between each pair of spokes, wedge shaped pieces of metal are placed, and which are connected together by a bolt, passed through a hole formed therein—the lower extremity of the said bolt having a thread cut about it; a corresponding thread, or screw, being formed in the hole in the wedge, into which the bolt takes; and by turning round the said bolt in one direction, by means of a key, or spanner, placed upon the head of the bolt, the wedge shaped pieces will be made to approach towards each other, which will have the effect of compressing the curved sides of the spokes, and thereby cause that part of the spoke, which is in contact with the felloe, to be pressed forcibly against it; and such pressure will be transmitted from the felloe to the tire, and in this manner, and by these means, I form a solid and substantial wheel.

Another form of construction of wheel, to be applied to vehicles used on railways, consists in having the cast iron boss, or nave, of the wheel formed in two parts, the tire being connected to the boss, or nave, in the following manner:—The boss, or nave, has holes formed therein, through which bolts are passed, in a radial direction, from the centre of the wheel, the said bolts being employed for the purpose hereinafter mentioned, connected to the boss, or nave, of the wheel by countersunk bolts and nuts, passed through holes formed in the parts of the nave and block, the outer extremity of each of the blocks being securely connected to a ring of wrought iron formed with two flanges, by means of countersunk bolts, passed through holes formed in the tire, the ring and block; there is a hole formed through the center of each block and fitted with a short tube of metal, for the purpose of connecting these last mentioned parts together means of a split key passed thro' a hole in the end of the bolt. Wedge shaped pieces of metal are placed between each pair of wood blocks, and connected thereto, and to the boss, or nave, by a bolt and nut or the bolt may be either cast into the nave of the wheel, in which case, there would be a nut upon its other extremity, or the said bolt may be screwed into the nave of the wheel instead of passing through it, by turning round the bolt by means of a key, or spanner. The wedge shaped piece will be forcibly pressed against and between each pair of blocks, and as each of these wedges is successively tightened, it will be obvious that each block will be compressed. The grain, or fibre, of the wood blocks, must be placed radiating from the center of the wheel, and in this manner, and by these means, I form a solid and substantial wheel. It should be observed, that the wedges may be easily tightened from time to time by the means before described, should the shrink-

age of the wood blocks require it. Another form of construction of wheel is exhibited, which is only a modification of the wheel first described. In this case the wooden felloe is entirely dispensed with, the spokes being in close contact with the tire of the wheel, and connected thereto in a similar manner to the former wheel. Another part of my invention consists in constructing wheels upon the principle hereinbefore particularly described, with reference to wheels to be used on railways. The difference consists simply in making the tire of the wheel for common roads flat instead of flanged, and the nave must be formed to suit the axle upon which it is to be placed; in other respects, the arrangement and construction of the wheels are similar to those before described and represented.

Claims.—Firstly, the use and application of wedges, or wedged shaped pieces of metal, in combination with, and adapted to, curved or bent spokes of metal, in the manner and for the purpose hereinbefore particularly described (with reference to *figs* 1, 2, 3, 8, 9, 10, of the sheet of drawings annexed to the specification).—Secondly, I claim the application of wedges, or wedge shaped pieces of metal, in combination with blocks of wood, either of the form shown or hexagonal, arranged in the manner, and for the purpose hereinbefore particularly described (with reference to *figs.* 4, 5, 6, 7, of the sheet of drawings annexed to the specification.)—*Min. Jour.*

Indiana.

Indianapolis and Bellefontaine Railroad Co.

The annual meeting of this company for choice of officers took place at Anderson on the 4th inst., at which Jeremiah Smith, William M. Way, Peter S. Miller, and David Heaston, from the county of Randolph; Jas. Truitt, Samuel P. Anthony, James L. Russey, and David Kilgore, from the county of Delaware; Allen Makepeace, William Sparks, Robert N. Williams, and James Gray, from the county of Madison; Thos. R. Noel, from the counties of Hamilton and Hancock; Robert R. Underhill, and O. H. Smith, from the county of Marion, were chosen directors.

Hon. Oliver H. Smith was re-elected president, James G. Jordan secretary, Austin W. Morris treasurer, and Thomas A. Morris engineer.

The executive committee elected for the year consists of Jeremiah Smith, R. N. Williams, Thos. R. Noel, R. R. Underhill, and James L. Russey.

Our readers will recollect that in our paper of the 7th instant we gave a detailed statement of the affairs of this road, taken from the first annual report of the president, made to the directors in March last. The progress made since that time will be seen in the address of the president to the directors at the late meeting, a portion of which we are happy to lay before our readers. He says:

"Having in March last published my first annual report, I deem it unnecessary on this occasion to go into a detailed statement of our affairs and prospects. It may however be proper to say generally, that since the date of my report, about four months, there have been added to our subscribers 560, making our present number 1880. Our cash subscriptions of general and special stock have increased $64,000, and our land subscriptions $13,500, making the addition to our subscriptions, since my last report, $77,500, while our energetic stock solicitors are actively and successfully engaged in taking and closing stock.

The interest on the few bonds we have issued, has been punctually paid, and all our pecuniary arrangements have been faithfully discharged. Since my report, we have let the graduation of the first general section of twenty-seven miles, from Indianapolis to Pendleton and the contractors are rapidly progressing with the work. It is proper that I should say here, that I have deemed it proper to the success and harmony of the work, to discourage the use of spirituous liquors on the line, in the most decided terms—a policy which I desire to see rigidly enforced by the contractors. The contract prices of preparing this section for the superstructure are under $1500 to the mile, including grubbing, grading, and all other work, This section will be ready for the superstructure this season, and we anticipate the final location of the whole line, and the letting of the clearing off the timber, and the grubbing of the other general sections, from Pendleton to the Ohio line, in the course of the summer and coming fall, payable out of the special stock, so that it is manifest that our present condition and prospects fully justify the universal confidence now felt, in the success of our great enterprise.

It may not be improper to say a word upon the character of our road, as compared with other roads of a like character in other States. In a table in the American Railroad Journal, I find the average of the highest grade of 31, American Road, to be 42½ feet to the mile. The average cost of construction and equipments of 65 given American Railroads is $31,751 per mile; our road with the heavy T rail, right of way, depots, and ample equipments, will not exceed 10,000 per mile, and still the annual dividends of those roads, so far as the are given average 7 1-3 per cent. on their immense cost. I see it published, that the average cost of construction and equipments of the English Railways, all with double tracks, is $150,000 per mile; and yet these roads make 4½ per cent. annual dividends; if this be so, what must our work, unlimited in dividends, divide, when it shall be made, and our connection with the Eastern, Western, Southern, and other roads now in progress shall be completed.

Since, then, it is no longer a question that our road of 83 miles, is to be an important link in the most direct line of Railways from the Atlantic cities of Boston, New York, Philadelphia, and Baltimore, through the centre of this great valley, there remains no doubt whatever of the importance of the work, the ultimate value of the stocks, and of the propriety of constructing the road upon the most permanent gravel basis, and with the most substantial oak superstructure, and the heavy T rail, so as to ensure the utmost durability and capacity, and the highest rate of speed.

A railroad, "constructed upon the most permanent gravel basis, and with the most substantial oak superstructure, and a heavy T rail, so as to ensure the utmost durability and capacity, and the highest rate of speed," costing only $10,000 per mile, must make an Englishman stare, who cannot get a charter thro' parliament for an equal sum, nor build a road for less than fifteen times as much money! Yet we can assure him that the estimates of the gentlemen connected with this road are probably within the mark. The cheapness with which railroads can be built in the west, will lead to their use there more universally than in any other part of the world. Every good agricultural section possessing a moderately dense population, has sufficient strength to build one, and they will soon become the ordinary means of transit both of travel and merchandise. For reasons to which we have often alluded, the roads in the west will be most economically built. We would here urge the great importance of roads securing in the outset ample accommodation for depots and stations, when it can easily be done at trifling expense. The neglect of this at the right time, and the enormous sums required for new purchases of land, made valuable by the roads themselves, to meet an increased business of companies, have seriously lessened the value of the stocks of many roads in the east.

☞ As the year has more than half elapsed since our volume commenced, we shall esteem it a great favor it those indebted for their subscriptions for the current year will *at once* forward us the amount due.

☞ In consequence of complaints that pamphlet postage is charged at some offices on our paper, we have been compelled to discontinue the stitching and trimming of it—which work we must turn over to our subscribers.

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July, 27, 1849.

To Contractors.

SEALED PROPOSALS will be received at the office of the James River and Kanawha Company in Richmond, until the 20th day of August next, for the construction of the connection of the Company's Canal with the tide water of James River at Richmond, from the Basin along the line of the old locks, and through the Richmond dock. This work will consist of five locks of 13 8-10 feet lift, with short intermediate basins, such culverts, walls, wastes, street bridges, &c, as shall be necessary; the raising of the walls and embankment of the present Dock; the extension of the Dock a few hundred feet eastwardly; and the construction of an outlet lock at the lower end thereof, capable of admitting the largest vessels coming to the port of Richmond.

Sealed proposals will also be received at the same time and place, until the same date, for the construction of the following works:

1. For the construction of the connection of the Company's canal with the Rivanna river at Columbia. This work will consist of a canal four and a half miles long, a timber dam across the Rivanna river at Stillman's Mills, a stone guard-lock, and several culverts.

2. For the construction of the connection of the Company's canal with the James River at Cartersville.—This work will consist of a timber dam across James river, the excavation of a basin at Pemberton, and a canal from Pemberton to James river 1000 feet long, with a lock of 15 feet lift.

3. For the construction of the connection of the Company's canal with the James river Near new Canton.—This work will consist of a timber dam across James river, the excavation of a canal 1200 feet long, and a lock of 6 feet lift.

4. A wooden bridge across James river at Hardwicksville 724 feet long, supported by stone piers about 140 feet apart.

5. a wooden bridge across James river at Bent Creek 870 feet long, supported by stone piers about 140 feet apart.

This work will be paid for in current bank notes. Besides the usual reservation of 20 per cent. on the monthly estimates, the contractor or contractors will be required to give ample security, satisfactory to the board of Directors, for the completion of the work at the time and in the manner specified in the contracts.

Plans of the above work will be exhibited, and specifications thereof delivered to the contractors, at the Company's office in Richmond, by the 5th day of August next, on application to Mr. E. H. Gall, the Engineer in charge of the other works above enumerated. After the receipt of the proposals, time will be taken for the consideration thereof until the 23rd of the same month, on which day, in case the proposals should be found satisfactory, the several jobs, as above advertised, will be let.

WALTER GWYNN.
Chief Engineer J. R. & K. Co.
Richmond, July 16, 1849. 3t29

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June 8, 1849.

Railroad Iron.

THE TRENTON IRON COMPANY ARE NOW turning out one thousand tons of rails per month, at their works at Trenton, N. J. They are prepared to enter into contract to furnish rails of any pattern, and of the very best quality, made exclusively from the famous Andover iron. The position of the works on the Delaware river, the Delaware and Raritan canal, and the Camden and Amboy railroad, enables them to ship rails at all seasons of the year. Apply to
COOPER & HEWITT, *Agents.*
17 Burling Slip, New York.
October 30. 1848.

American Cast Steel.

THE ADIRONDAC STEEL MANUFACTURING CO. is now producing, from American iron, at their works at Jersey City, N.J., Cast Steel of extraordinary quality, and is prepared to supply orders for the same at prices below that of the imported article of like quality. Consumers will find it to their interest to give this a trial. Orders for all sizes of hammered cast steel, directed as above, will meet with prompt attention.
May 28, 1849.

SPRING STEEL FOR LOCOMOTIVES, TENDERS AND CARS.—The subscriber is engaged in manufacturing spring steel from 1¼ to 6 inches in width, and of any thickness required: large quantities are yearly furnished for railroad purposes, and wherever used its quality has been approved of. The establishment being large, can execute orders with great promptitude, at reasonable prices, and the quality warranted. Address J. F. WINSLOW, *Agent,*
Albany Iron and Nail Works.

Pig and Bloom Iron.

THE Subscribers are Agents for the sale of numerous brands of Charcoal and Anthracite Pig Iron, suitable for Machinery, Railroad Wheels, Chains, Hollowware, etc. Also several brands of the best Puddling Iron, Juniata Blooms suitable for Wire, Boiler Plate, Axe Iron, Shovels, etc. The attention of those engaged in the manufacture of Iron is solicited by
A. WRIGHT & NEPHEW,
Vine Street Wharf, Philadelphia.

Railroad Iron.

RAILROAD IRON & LOCOMOTIVE TIRES imported to order, and constantly on hand, by
A. & G. RALSTON,
4 South Front St., Philadelphia.

Railroad Iron.

THE MOUNT SAVAGE IRON WORKS, Alleghany county, Maryland, having recently passed into the hands of new proprietors, are now prepared, with increased facilities, to execute orders for any of the various patterns of Railroad Iron. Communications addressed to either of the subscribers will have prompt attention. J. F. WINSLOW, *President*
Troy, N.Y.
ERASTUS CORNING, Albany.
WARREN DELANO, Jr., N.Y.
JOHN M. FORBES, Boston.
ENOCH PRATT, Baltimore, Md.
November 6, 1848.

WILLIAM JESSOP & SONS'
CELEBRATED CAST-STEEL.

The subscribers have on hand, and are constantly receiving from their manufactory,
PARK WORKS, SHEFFIELD,
Double Refined Cast Steel—square, flat and octagon.
Best warranted Cast Steel—square, flat and octagon.
Best double and single Shear Steel—warranted.
Machinery Steel—round.
Best and 2d gy. Sheet Steel—for saws and other purposes.
German Steel—flat and square, "W. I. & S." "Eagle" and "Goat" stamps.
Genuine "Sykes," L Blister Steel.
Best English Blister Steel, etc., etc., etc.
All of which are offered for sale on the most favorable terms by WM. JESSOP & SONS,
91 John street, New York.
Also by their Agents—
Curtus & Hand, 47 Commerce street, Philadelphia.
Alex'r Fullerton & Co., 119 Milk street, Boston.
Stickney & Beatty, South Charles street, Baltimore.
May 6, 1848.

Railroad Iron.

100 Tons 2½ x ½, | 30 Tons Railroad.
All fit to re-lay. For sale cheap by
PETTEE & MANN,
228 South St., New York.
May 16, 1849.

MANUFACTURE OF PATENT WIRE ROPE and Cables for Inclined Planes, Standing Ship Rigging, Mines, Cranes, Tillers, etc, by
JOHN A. ROEBLING, *Civil Engineer,*
Pittsburgh, Pa.
These *Ropes* are now in successful operation on the planes of the Portage railroad in Pennsylvania, on the Public Slips, on Ferries, and in Mines. The first rope put upon Plane No. 3, Portage railroad, has now run four seasons, and is still in good condition.

Iron.

THE Works of the New Jersey Iron Company at Boonton, N. J., having been recently enlarged and put in good repair, the company are prepared to receive orders for Iron, which will be executed with dispatch; and they warrant their iron equal in quality and finish to any in this country.
½ Round and square, to 6 inches,
½ Flat 4 "
Ovals, half-ovals and half-round.
Hoop, band and scroll iron.
Nail plates, superior charcoal Horse shoe,
Iron, sheet and Boiler iron,
Tire iron for locomotives,
Railroad spikes.
Pig iron of superior quality for chilling.
do, for foundry purposes.
For sale by JOHN F. MACKIE,
85 & 87 Broad Street,
Sole agent for the New Jersey Iron Co,
June 9, 1849.

Railroad Iron.

THE UNDERSIGNED ARE PREPARED TO contract for the delivery of English Railroad Iron of favorite brands, during the Spring. They also receive orders for the importation of Pig, Bar, Sheet, etc. Iron. THOMAS B. SANDS & CO.,
22 South William street,
February 3, 1849. New York.

Railroad Iron.

THE SUBSCRIBERS ARE PREPARED TO take orders for Railroad Iron to be made at their Phœnix Iron Works, situated on the Schuylkill River, near this city, and at their Safe Harbor Iron Works, situated in Lancaster County, on the Susquehannah river; which two establishments are now turning out upwards of 1800 tons of finished rails per month.
Companies desirous of contracting will be promptly supplied with rails of any required pattern, and of the very best quality.
REEVES, BUCK & CO.,
45 North Water St., Philadelphia.
March 15, 1849.

Railroad Iron.

THE Undersigned offer for sale 3000 Tons Railroad Iron at a fixed price, to be made of any required ordinary section, and of approved stamp.
They are generally prepared to contract for the delivery of Railroad Iron, Pig, Bar and Sheet Iron—or to take orders for the same—all of favorite brands, and on the usual terms. ILLIUS & MAKIN.
41 Broad street.
March 29, 1849. 3m.13

American Pig, Bloom and Boiler Iron.

HENRY THOMPSON & SON,
No 57 South Gay St., Baltimore, Md.,
Offer for sale, *Hot Blast* Charcoal *Pig Iron* made at the *Catoctin* (Maryland), and *Taylor* (Virginia), *Furnaces; Cold Blast* Charcoal Pig Iron from the *Cloverdale* and *Catawba*, Va., Furnaces, suitable for *Wheels* or *Machinery* requiring *extra* strength; also *Boiler* and *Flue Iron* from the mills of Edge & Hilles in Delaware, and *best quality Boiler Blooms* made from *Cold Blast Pig Iron* at the *Shenandoah Works*, Va. The productions of the above establishments can always be had at the lowest market prices for approved paper.
American Pig Iron of other brands, and *Rolled* and *Hammered Bar Iron* furnished at lowest prices. Agents for *Watson's Perth Amboy Fire Bricks*, and Rich & Cos. New York Salamander Iron Chests.
Baltimore, June 14, 1849. 6 mos

Iron Wire.

REFINED IRON WIRE OF ALL KINDS, Card, Reed, Cotton-flyer, Annealed, Broom, Buckle, and Spring Wire. Also all kinds of Round, Flat or Oval Wire, best adapted to various machine purposes, annealed and tempered, straightened and cut any length, manufactured and sold by
ICHABOD WASHBURN.
Worcester, Mass., May 25, 1849.

American and Foreign Iron.

FOR SALE,

300	Tons	A 1, Iron Dale Foundry Iron.
100	"	1, " " "
100	"	2, " " "
100	"	" Forge "
400	"	Wilkesbarre " "
100	"	"Roaring Run" Foundry Iron.
300	"	Fort " "
50	"	Catoctin " "
250	"	Chikiswalungo " "
50	"	"Columbia" "chilling" iron, a very superior article for car wheels.
75	"	"Columbia" refined boiler blooms.
30	"	1 x ¼ Slit iron.
50	"	Best Penna. boiler iron.
50	"	"Puddled" "
50	"	Bagnall & Sons refined bar iron.
50	"	Common bar iron.

Locomotive and other boiler iron furnished to order.
GOODHUE & CO.,
64 South street
New York.

PATENT HAMMERED RAILROAD, SHIP & BOAT SPIKES. — The Albany Iron Works have always on hand, of their own manufacture, a large assortment of Railroad, Ship and Boat Spikes from 2 to 12 inches in length, and of any form of head From the excellence of the material always used in their manufacture, and their very general use for railroads and other purposes in this country, the manufacturers have no hesitation in warranting them fully equal to the best spikes in market, both as to quality and appearance. All orders addressed to the subscribers at the works will be promptly executed.
JOHN F. WINSLOW, *Agent.*
Albany Iron and Nail Works, Troy, N. Y.
The above Spikes may be had at factory prices, of Erastus Corning & Co Albany; Merritt & Co., New York; E. Pratt & Bro. Lee, Baltimore Md

LAP—WELDED
WROUGHT IRON TUBES
FOR
TUBULAR BOILERS,
FROM 1 1-2 TO 8 INCHES DIAMETER.

These are the ONLY Tubes of the same quality and manufacture as those so extensively used in England, Scotland, France and Germany, for Locomotive, Marine and other Steam Engine Boilers
THOMAS PROSSER,
Patentee.
28 Platt street, New York.

Roman Cement,

OF the best quality, now landing from ship Hendrick Hudson, from London, made by Billingsley, Mial & Co., and superior to anything of the kind manufactured in England. For sale by G. T. SNOW,
109 Water Street, New York.

Large Wooden Pumps.

SEVERAL Large Wooden Square Pumps, of various sizes from 6 to 24 inches, and lengths from 10 to 25 feet, strongly bolted and strapped together with wrought iron; and used to great advantage on the Boston Water works; also two screw pumps each 25 feet long and 2½ feet in diameter, are now for sale by the Boston Water Commissioners.

For further particulars inquire at No. 119 Washington Street, Boston, or of E. S. CHESBROUGH,
West Newton.

June 8, 1849.

P. S. DEVLAN & CO's Patent Lubricating Oil.

THE Subscribers invite the attention of Railroads, Steamboats, Machinists, etc., to the above article of Oil; they are prepared to supply it in any quantity. Certificates of its superiority over all other oils, from several of the largest Works and Railroads, can be seen at our office. KENNEDY & GELSTON,
5½ Pine street, New York,

Sole Agents for the New England States and State of New York. 1y14

TO RAILROAD COMPANIES AND MANUfacturers of Railroad Machinery. The subscribers have for sale American and English Bar Iron, of all sizes; English Blister, Cast, Shear and Spring Steel; Juniata Rods; Car Axles, made of double refined iron; Sheet and Boiler Iron, cut to pattern; Tires for Locomotive Engines, and other railroad carriage wheels, made from common and double refined B. O. Iron; the latter a very superior article. The Tires are made by Messrs. Baldwin and Whitney, Locomotive Engine Manufacturers of this city. Orders addressed to them, or to us, will be promptly executed.

When the exact diameter of the wheel is stated in the order, a fit to those wheels is guaranteed, saving to the purchaser the expense of turning them out inside.

THOMAS & EDMUND GEORGE,
a45 N. E. cor. 12th and Market sts., Philad., Pa.

To Railroad Companies and Contractors.

FOR SALE.—Two Locomotive Engines and Tenders, at present in use on the Beaver Meadow Railroad, being too light for their coal trains, but well calculated for either gravel or light passenger trains.

They weigh, in running order, about 8 tons each—having one pair of driving wheels 4 feet diameter, 4 truck wheels 30 inches diameter, with cylinders 10 in. diameter, and 18 inches stroke of piston. Tenders on 4 wheels. Address JAMES ROWLAND,
Prest. Beaver Meadow Railroad & Coal Co.,
Philadelphia.
or, L. CHAMBERLAIN, Sec'y,
at Beaver Meadow, Pa.

May 19, 1849. 20tf

India-rubber for Railroad Cos.

RUBBER SPRINGS—*Bearing and Buffer—Fuller's Patent—Hose* from 1 to 12 inches diameter. Suction Hose. *Steam Packing*—from 1-16 to 2 in. thick. *Rubber and Gutta Percha Bands.* These articles are all warranted to give satisfaction, made under Tyer & Helm's patent, issued January, 1849.—No lead used in the composition. Will stand much higher heat than that called "Goodyear's," and is in all respects better than any in use. Proprietors of railroads do not be overcharged by pretenders.

HORACE H. DAY,
Warehouse 23 Courtlandt street.

New York, May 21, 1849.

NICOLL'S PATENT SAFETY SWITCH FOR Railroad Turnouts. This invention for some time in successful operation on one of the principal railroads in the country, effectually prevents engines and their trains from running off the track at a switch, left wrong by accident or design. It acts independently of the main track rails; being laid down or removed without cutting or displacing them.

It is never touched by passing trains, except when in use, preventing their running off the track. It is simple in its construction and operation, requiring only two castings and two rails; the latter, even if much worn or used, not objectionable.

Working models of the Safety Switch may be seen at Messrs. Davenport, Bridges & Kirk's Cambridge Port, Mass., and at the office of the Railroad Journal, New York.

Plans, Specifications, and all information obtained, on application to the Subscriber, Inventor and Patentee. G. A. NICOLLS,
Reading, Pa.

Large Pumps.

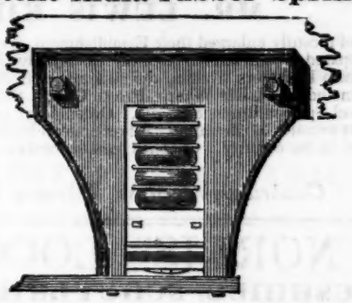
THE Boston Water Commissioners offer for sale a large number and variety of Wooden Square Pumps, used in clearing excavations from water during the construction of the Aqueducts.

Also Two Large Screw Pumps, each 25 feet long and 2½ feet in diameter.

For further particulars, enquire at the office of the Water Commissioners, 119 Washington St., Boston, or of E. S. Chesbrough, West Newton.

May 19, 1849. 6w20

Patent India-rubber Springs.



FULLER & CO. beg that parties interested in the use of these Springs will not be misled by ex-parte statements, but will examine the actual Patents and judge for themselves.

The statements made by Messrs. Crane & Ray shall be treated seriatim.

They claim to have first introduced India-rubber Springs about two years since, whereas they were used by Fuller & Co. nearly four yeas ago.

They claim the exclusive right to use Sprngs. They have no right whatever; every spring they make is an infringement upon Fuller's patent, dated 1845. They claim the sole right to make India rubber, and apparently think because a species of India-rubber was patented some years since, that no person can make any other now. A patent was *granted in January last* to Messrs. Tyer & Helm for a new and improved kind of Vulcanized rubber which is used by Fuller & Co.

Fuller's springs it is needless to say are in very general use, although Messrs. Crane & Ray pretend that they know of only one or two instances. Fuller & Co. guarantee all parties who use their springs.

As to the Legal proceedings—an action has been commenced against one company for an alleged infringement of Goodyear's patent, but is being defended with every prospect of success. An action has also been commenced by Fuller & Co., against parties for an infringement of Fuller's patent, and *this will be done in every case of violation.*

In every case in which Fuller's spring has been applied, it has been pronounced superior to that made by Mr. Ray, and this fact induces Messrs. Crane & Ray to claim the right of using it. They attempt to lead the public from the real question at issue, by producing a Deposition as to Mr. Ray having *tried to make* a spring which Mr. Fuller *did make* and patent. If Mr. Ray did invent a spring in 1844, why did he not apply for a patent, and not wait until 1848, when his application was rejected!

Mr. Knevitt has never stated that the springs were put on by him, which are refered to in Mr. Hale's article, but he does state that those springs are made according to Mr. Fuller's specification, and consequently are an infringement upon it. The article of Mr. Hale in the Boston Advertiser, quoted by Messrs Crane & Ray, was followed immediately by a letter in the same paper, from Mr. Knevitt, setting forth the facts of the case.

The springs refered to were put on by Mr. Ray before Mr. Knevitt came to the United States; when he arrived he gave Mr. Ray notice not to proceed further in making or vending such springs; Mr. Ray then said he did not wish to infringe, and would not continue to do so, and he then contrived an India-rubber and Air spring which totally failed.

In the selection of their first agent, Fuller & Co. were particularly unfortunate, and their reason for adverting to it is simply that it may tend to throw light on subsequent transactions, and furnish a reply to the remark, "that this opposition was invited by their own delay in getting the thing to work." The individual refered to undertook the agency for Fuller's springs, and left Liverpool on the 1st January, 1847, furnished with a complete set of drawings, models, etc., and every necessary instruction to make arrangements respecting the supply of material, and to have it at work within the time limited by law; but *from that hour to the present, not a single communication has been received from the said agent.* Some of their models, however, they have traced into the hands of parties now seeking to invade their rights, and by whom they understand they have been exhibited as specimens of their own invention.

The superiority of Fuller's spring is implied in the offer of the New England Car Co. to make springs upon his principle (now that a preference is given to the disc and plate form) and this notwithstanding the fact, that Fuller & Co. have a patent, and that Mr. Ray's application for one was rejected. The public can judge which company's course has been the most honorable, or whose statements are entitled to consideration.

Fuller's springs can be obtained of *Mr. Knevitt* the Agent, at 38 Broadway New York, and of *Messrs. James Lee & Co.*, 18 India Wharf, Boston.

May 26, 1849.

C. W, Bently & Co.,

PORTABLE Steam Engine and Boiler Manufacturers, East Falls Avenue, near Pratt St. Bridge,
BALTIMORE, MARYLAND.

Their Engines are simple in their construction, compact and durable; they require no brick work in setting them, and occupyidg but a small space (a six horse power engine and boiler, standing on a cast iron plate of three by six feet.)

They also manufacture Major W. P. Williamson's new oscillating Engine; a superior article, combining cheapness and simplicity (one of which may be seen in operation at their shop.) Both of these engines are adapted to any purpose where power is required, and may be made of any capacity; and for economy in use of fuel are unsurpassed.

All kinds of machinery made to order. Steam Generators, Force Pumps, Wrought Iron Pipes and Fillings for Steam, Water, Gas, etc., constantly on hand,

Baltimore, June 6, 1849.

PHILADELPHIA CAR MANUFACTORY,

CORNER SCHUYLKILL 2D AND HAMILTON STS.,
SPRING GARDEN, PHILADELPHIA CO., PA.

Kimball & Gorton,

Having recently constructed the above works, are prepared to construct at short notice all kinds of

RAILROAD CARS, Viz:

Passenger Cars of all classes—Open and Covered Freight and Express Cars—Coal Cars—Hand Cars & Trucks of all descriptions.

They are also prepared to furnish Chilled Wheels of any pattern. Car Wheels & Axles fitted and furnished. Snow Ploughs and Tenders made to order. Steel and other Springs always on hand.

All orders will be filled at short notice, and upon as good terms as at any other establishment in the country.

Omnibuses from the Exchange run within one square of the manufactory every 10 minutes during the day.

Philadelphia, June 6, 1849. 1y25

LAWRENCE'S ROSENDALE HYDRAULIC Cement. This Cement is warranted equal to any manufactured in this country, and has been pronounced superior to Francis' "Roman." Its value for Aqueducts, Locks, Bridges, Flooms, and all Masonry exposed to dampness, is well known, as it sets immediately under water, and increases in solidity for years.

For sale in lots to suit purchasers, in tight papered barrels, by JOHN W. LAWRENCE,
142 Front-street, New York.

☞ Orders for the above will be received and promptly attended to at this office. 32 1y.

Text Book of Mechanical Drawing,

FOR the use of SCHOOLS and SELF-INSTRUCTION, containing,

1st. A series of progressive practical problems in Geometry, with full explanations, couched in plain and simple terms; showing also the construction of the *parallel ruler, plane scales* and *protractor.*

2d. Examples for drawing *plans, sections* and *elevations* of Buildings and Machinery, the mode of drawing elevations from *circular* and *polygonal* plans, and the drawing of Roman and Grecian Mouldings.

3d. An introduction to *Isometrical drawing*, with 4 plates of examples.

4th. A treatise on *Linear Perspective*, with numerous examples and full explanations, rendering the study of the art easy and agreeable.

5th. Examples for the projection of shadows.

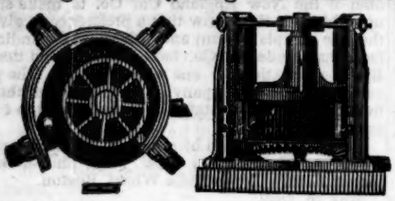
The whole illustrated with 50 STEEL PLATES.

Published by WM. MINIFIE & CO.,
114 Baltimore St., Baltimore, Md.

Price $3, to be had of all the principal booksellers.

MACHINERY.

Henry Burden's Patent Revolving Shingling Machine.



THE Subscriber having recently purchased the right of this machine for the United States, now offers to make transfers of the right to run said machine, or sell to those who may be desirous to purchase the right for one or more of the States.

This machine is now in successful operation in ten or twelve iron works in and about the vicinity of Pittsburgh, also at Phœnixville and Reading, Pa., Covington Iron Works, Md., Troy Rolling Mills, and Troy Iron and Nail Factory, Troy, N. Y., where it has give universal satisfaction.

Its advantages over the ordinary Forge Hammer are numerous: considerable saving in first cost; saving in power; the entire saving of shingler's, or hammersman's wages, as no attendance whatever is necessary, it being entirely self-acting; saving in time from the quantity of work done, as one machine is capable of working the iron from sixty puddling furnaces; saving of waste, as nothing but the scoria is thrown off, and that most effectually; saving of staffs, as none are used or required. The time required to furnish a bloom being only about six seconds, the scoria has no time to set, consequently is got rid of much easier than when allowed to congeal as under the hammer. The iron being discharged from the machine so hot, rolls better and is much easier on the rollers and machinery. The bars roll rounder, and are much better finished. The subscriber feels confident that persons who will examine for themselves the machinery in operation, will find it possesses more advantages than have been enumerated. For further particulars address the subscriber at Troy, N. Y. P. A. BURDEN.

Railroad Spikes and Wrought Iron Fastenings.

THE TROY IRON AND NAIL FACTORY, exclusive owner of all Henry Burden's Patented Machinery *for making Spikes*, have facilities for manufacturing large quantities upon short notice, and of a quality unsurpassed.

Wrought Iron Chairs, Clamps, Keys and Bolts for Railroad fastenings, also made to order. A full assortment of Ship and Boat Spikes always on hand.

All orders addressed to the Agent at the Factory will receive immediate attention.

P. A. BURDEN, *Agent*,
Troy Iron and Nail Factory, Troy, N. Y.

RAILROAD WHEELS.

CHILLED RAILROAD WHEELS.—THE UNdersigned are now prepared to manufacture their Improved Corrugated Car Wheels, or Wheels with any form of spokes or discs, by a new process which prevents all strain on the metal, such as is produced in all other chilled wheels, by the manner of casting and cooling. By this new method of manufacture, the hubs of all kinds of wheels may be made whole—that is, without dividing them into sections—thus rendering the expense of banding unnecessary; and the wheels subjected to this process will be much stronger than those of the same size and weight, when made in the ordinary way.

A. WHITNEY & SON,
Willow St., below 13th,
Philadelphia, Pa.

CHILLED RAILROAD WHEELS.—THE UNdersigned, the *Original Inventor* of the *Plate Wheel* with solid hub, is prepared to execute all orders for the same, promptly and faithfully, and solicits a share of the patronage for those kind of wheels which are now so much preferred, and which he originally produced after a large expenditure of time and money.

A. TIERS,
Point Pleasant Foundry.

He also offers to furnish Rolling Mill Castings, and other Mill Gearing, with promptness, having, he believes, the largest stock of such patterns to be found in the country. A. T.

Kensington, Philadelphia Co.,
March 12, 1848.

ENGINE AND CAR WORKS.

DAVENPORT & BRIDGES,

HAVING ASSOCIATED WITH THEM

MR. LEWIS KIRK, OF READING, PA.,

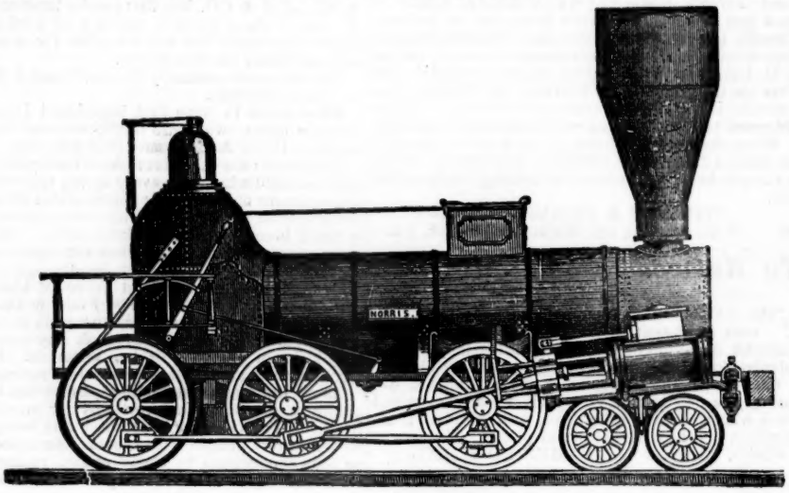
And recently enlarged their Establishment, (making it now the most extensive in the United States,) they are prepared to manufacture to order Locomotive Engines and Cars of every description. Stationary Engines, Steam Hammers, Boilers, and all kinds of Railroad Machinery. Also, Castings and Forge Irons of all kinds—including Chilled Wheels, Frogs, Chairs, Switches, Car Axles, and Locomotive Cranks, Connecting Rods, Steel Springs, Bolts, etc., etc. Orders from all parts of the country solicited for Engines and Cars, or any part or parts of the same. All orders will be furnished at short notice, and on as good terms as any manufactory in the country. Coaches pass our works every fifteen minutes during the day, from Brattle St., Boston.

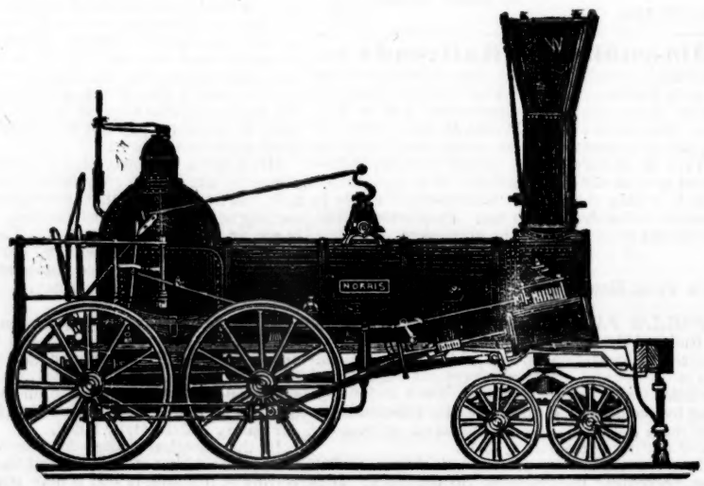
DAVENPORT, BRIDGES & KIRK.

Cambridgeport, Mass., February 16th, 1849.

NORRIS' LOCOMOTIVE WORKS.

BUSHHILL, SCHUYLKILL SIXTH-ST., PHILADELPHIA,





THE UNDERSIGNED Manufacture to order Locomotive Steam Engines of any plan or size.

Their shops being enlarged, and their arrangements considerably extended to facilitate the speedy execution of work in this branch, they can offer to Railway Companies unusual advantages for prompt delivery of Machinery of superior workmanship and finish.

Connected with the Locomotive business, they are also prepared to furnish, at short notice, Chilled Wheels for Cars of superior quality.

Wrought Iron Tyres made of any required size—the exact diameter of the Wheel Centre, being given, the Tires are made to fit on same without the necessity of turning out inside.

Iron and Brass castings, Axles, etc., fitted up complete with Trucks or otherwise.

NORRIS, BROTHERS.